ONE METRO WEST

Final EIR | May 2020

Prepared by: Michael Baker International

FINAL ENVIRONMENTAL IMPACT REPORT

One Metro West

State Clearinghouse No. 2019050014

LEAD AGENCY:

City of Costa Mesa
77 Fair Drive
Costa Mesa, California 92628
Contact: Minoo Ashabi
714.754.5245

May 2020

JN 172326

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Chapter 1 Introduction

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1. Introduction

1.1 PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

1.1.1 California Environmental Quality Act Compliance

In accordance with the *California Environmental Quality Act Guidelines* (CEQA Guidelines) Section 15088, the City of Costa Mesa, as the Lead Agency, has evaluated the comments received on the *One Metro West Draft Environmental Impact Report* (Draft EIR).

The Draft EIR for the proposed One Metro West (herein referenced as the project) was distributed to potential responsible and trustee agencies, interested groups, and organizations. The Draft EIR was made available for public review and comment for a period of 52 days. The public review period for the Draft EIR established by the CEQA Guidelines commenced on February 7, 2020, ended on March 23, 2020, and was extended until March 30, 2020 (an additional seven days due to the COVID-19 pandemic).

The Final EIR consists of the following components:

- Chapter 1 – Introduction;
- Chapter 2 – Response to Comments;
- Chapter 3 – Errata; and
- Chapter 4 – Mitigation Monitoring and Reporting Program.

Due to its length, the text of the Draft EIR is not included with this document; however, it is included by reference in this Final EIR. None of the corrections or clarifications to the Draft EIR identified in this document constitutes "significant new information" pursuant to CEQA Guidelines Section 15088.5. As a result, a recirculation of the Draft EIR is not required.

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Chapter 2 Response to Comments

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2. Response to Comments

In accordance with the *California Environmental Quality Act Guidelines* (CEQA Guidelines) Section 15088, the City of Costa Mesa, as the Lead Agency, evaluated the written comments received on the Draft Environmental Impact Report (EIR) (State Clearinghouse No. 2019050014) for One Metro West (herein referenced as the project) and has prepared the following responses to the comments received. This Response to Comments chapter is part of the Final EIR in accordance with CEQA Guidelines Section 15132.

A list of public agencies, tribes, organizations, and persons of interest that provided comments on the Draft EIR is presented below. Each comment letter is assigned a letter number. Individual comments within each communication have been numbered so comments can be cross-referenced with specific responses. Following this list, the text of the communication is reprinted and followed by the corresponding response.

Table 2-1 Comment Letters Received

COMMENTER	DATE	LETTER NUMBER
AGENCIES		
Governor's Office of Planning and Research – State Clearinghouse and Planning Unit	March 24, 2020	A1
City of Irvine	March 9, 2020	A2
Mesa Water District	March 6, 2020	A3
California Department of Transportation	March 16, 2020	A4
South Coast Air Quality Management District	March 19, 2020	A5
Orange County Transportation Authority	March 23, 2020	A6
Orange County Public Works	March 23, 2020	A7
TRIBES		
Agua Caliente Band of Cahuilla Indians	February 18, 2020	T1
Rincon Band of Luiseno Indians	February 20, 2020	T2
Gabrieleno Band of Mission Indians – Kizh Nation	February 21, 2020	T3
ORGANIZATIONS		
Attorneys for the Southwest Regional Council of Carpenters	March 23, 2020	O1
Mesa Verde Community Inc.	March 20, 2020	O2
Costa Mesa First	March 23, 2020	O3
INTERESTED PERSONS		
Margaret Partnoff	February 18, 2020	P1

2. Response to Comments

Table 2-1 Comment Letters Received (continued)

COMMENTER	DATE	LETTER NUMBER
Dennis Ashendorf	February 26, 2020	P2
Arturo Manas	February 24, 2020	P3
Naveed Anwar, The Cheese Shop	February 28, 2020	P4
Michael Gregg	February 28, 2020	P5
Seth Hiromura, Steelwave	February 28, 2020	P6
Mike Mullen	March 5, 2020	P7
Daniel Tyner	March 9, 2020	P8
Mase Kazerani, Kaz Design Group	March 9, 2020	P9
Flo Martin	March 11, 2020	P10
Mark R. Scheurer	February 25, 2020	P11
Stéphane Duval, BoConcept	March 12, 2020	P12
Nicole Brunner, Nest Bedding	March 12, 2020	P13
Misa Sullivan	March 12, 2020	P14
Meredith Oliver	March 12, 2020	P15
Alexa Dordoni	March 12, 2020	P16
Chris Robertson	March 13, 2020	P17
Ian Stevenson, Trellis	March 17, 2020	P18
Kellan Liem	March 18, 2020	P19
Debra Marsteller, Project Independence	March 18, 2020	P20
Carter Jones	March 19, 2020	P21
Aaron Ludwig	March 20, 2020	P22
Donald Morrow	March 20, 2020	P23
Leigh White	March 20, 2020	P24
Michael Gonzaguirre	March 20, 2020	P25
Neal Burns	March 20, 2020	P26
Linda Rowlands	March 21, 2020	P27
Russell Rowlands	March 21, 2020	P28
Lance Huante	March 21, 2020	P29
Frederik Solter	March 22, 2020	P30
Michelle Figueredo-Wilson	March 22, 2020	P31

Table 2-1 Comment Letters Received (continued)

COMMENTER	DATE	LETTER NUMBER
Russell Toler	March 22, 2020	P32
Peter Olah, Paradigm Engineering Group	March 23, 2020	P33
John Merrill	March 23, 2020	P34
Robin Leffler	March 23, 2020 March 23, 2020	P35
Shawn McBride	March 23, 2020	P36
Tracey Valencia	March 23, 2020	P37
Jose De La Jara	March 23, 2020	P38
Todd Eckert	March 23, 2020 March 23, 2020	P39
Andrew Smith	March 23, 2020	P40
Jan Harmon	March 24, 2020	P41
Anne Marie Kane	March 23, 2020	P42
Devin Green	March 23, 2020	P43
Siamak Jafroudi, Petra Geosciences	March 23, 2020	P44
Russell Yarwood	March 20, 2020	P45
PUBLIC REVIEW EXTENSION THROUGH MARCH 30,2020		
Laurel Golden	March 26, 2020 March 29, 2020	P46
Elizabeth Grant	March 26, 2020	P47
Rita Popp	March 27, 2020	P48
Bill Partnoff	March 27, 2020	P49
Duane Smith	March 28, 2020	P50
Tamara Berardi	March 28, 2020	P51
Jason Thesing	March 27, 2020 March 29, 2020	P52
Bob Keyes	March 27, 2020	P53
Erik Schuman	March 27, 2020	P54
Kenneth Rhea	March 28, 2020	P55
John Brown	March 29, 2020	P56
Lisa Lacey	March 29, 2020	P57
Karla Stagman	March 29, 2020	P58
Raymond Polverini	March 29, 2020	P59
Marsha Shafer	March 29, 2020	P60

2. Response to Comments

Johnal Leifsson	March 27, 2020	P61
Bob Hagerty	March 29, 2020	P62
Peggy Partnoff	March 30, 2020	P63
Alyssa Thesing	March 30, 2020	P64
Athena Balistreri	March 30, 2020	P65
Michael Chun	March 30, 2020	P66
Bob Bernal	March 30, 2020	P67
Ryan Maloney	March 29, 2020	P68
Sandra Genis	March 30, 2020	P69
C MT	March 30, 2020	P70
Lehua Coley, Trellis	March 31, 2020	P71
Christine Palme	March 30, 2020	P72
George Atalla	March 19, 2020	P73
Jon Rowe	March 30, 2020	P74
Jan Giffard	March 30, 2020	P75
Mary Spadoni	March 23, 2020	P76
Sylvana Graham	March 30, 2020	P77
William Schallmo	March 30, 2020	P78

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Gavin Newsom
Governor

Kate Gordon
Director

March 24, 2020

Minoo Ashabi
Costa Mesa, City of
77 Fair Drive
Costa Mesa, CA 92626

Subject: One Metro West
SCH#: 2019050014

Dear Minoo Ashabi:

The State Clearinghouse submitted the above named EIR to selected state agencies for review. The review period closed on 3/23/2020, and the comments from the responding agency (ies) is (are) available on the CEQA database for your retrieval and use. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation." A1-1

Check the CEQA database for submitted comments for use in preparing your final environmental document: https://ceqanet.opr.ca.gov/2019050014/3 . Should you need more information or clarification of the comments, **we recommend that you contact the commenting agency directly**.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan
Director, State Clearinghouse

cc: Resources Agency

A1. RESPONSES TO COMMENTS FROM GOVERNOR'S OFFICE OF PLANNING AND RESEARCH – STATE CLEARINGHOUSE AND PLANNING UNIT, MARCH 24, 2020.

A1-1 This comment indicates that the State Clearinghouse submitted the Draft EIR to selected State agencies for review and that the comment period for the Draft EIR concluded on March 23, 2020. The comment indicates that the Lead Agency complied with the public review requirements for draft environmental documents pursuant to CEQA. As such, the comment does not provide specific comments regarding information presented in the Draft EIR, and no further response is necessary as part of the CEQA process/CEQA response to comments.

The comment also indicates that comments from responsible or other public agencies are available on the CEQA database. A comment letter from the California Department of Transportation was included in the CEQA database and is included as Comment Letter A4 in this Final EIR.

COMMENT LETTER A2

Community Development
1 Civic Center Plaza, Irvine, CA 92606-5208
cityofirvine.org
949-724-6000

March 9, 2020

Minoo Ashabi
City of Costa Mesa
Development Services Department
77 Fair Drive
Costa Mesa, CA 92626

Subject: Draft Environmental Impact Report for One Metro West in the City of Costa Mesa

Dear Minoo Ashabi:

The City of Irvine is in receipt of a Notice of Availability for an Environmental Impact Report (EIR) for One Metro West located at 1683 Sunflower Avenue in the City of Costa Mesa. The proposed project is a mixed-use development consisting of residential, specialty retail, creative office, and recreational uses. The proposed project includes 1,057 dwelling units (anticipated for rental), 25,000 square feet of commercial creative office, 6,000 square feet of specialty retail, and 1.7 acres of open spaces. A2-1

Staff reviewed the project and has no comments. If you have any questions, please contact me at 949-724-6364 or at jequina@cityofirvine.org.

Sincerely,

Justin Equina
Associate Planner

ec: Kerwin Lau, Manager of Planning Services
Marika Poynter, Principal Planner

A2. RESPONSES TO COMMENTS FROM CITY OF IRVINE, MARCH 9, 2020.

A2-1 The commenter provides a brief summary of the proposed project and states that City of Irvine staff have no comments on the Draft EIR. This comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments.

COMMENT LETTER A3

MesaWater DISTRICT®

Dedicated to Satisfying our Community's Water Needs

1965 Placentia Avenue
Costa Mesa, CA 92627
tel 949.631.1200
fax 949.574.1036
info@MesaWater.org
MesaWater.org

March 6, 2020

Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Development Services Department
77 Fair Drive
Costa Mesa, Ca 92626

REC'D MAR 10 2020

Subject: Notice of Availability for Draft EIR for One Metro West Project

Dear Ms. Ashabi:

Mesa Water District (District) has reviewed the Notice of Availability for a Draft Environmental Impact Report (Draft EIR) for the above referenced project and has the following comments

1. The District is the public agency responsible for the treatment and conveyance of potable water in the City of Costa Mesa. A3-1
2. The One Metro West project is within the District's current service area.
3. All water improvement plans for the project must be submitted to the District for Plan Check review in order to provide a permit for the project.
4. The existing potable water infrastructure in the project area will need to be evaluated to determine if sufficient capacity to serve the proposed project is available without infrastructure improvements. The EIR should address the following:
    - A hydraulic model will be required. One Metro West will need to fund the hydraulic model to be prepared by a consultant under contract with the District. A3-2
    - This hydraulic model will support the Water Supply Assessment that had been prepared in October 2019.
5. Depending upon the scope of the development, off-site water infrastructure improvements may be required.
6. The District plans on attending the scoping meetings for the public agencies to discuss the scope and content of the EIR.

Should you have any questions or comments please do not hesitate to contact me. Information regarding Mesa Water Standard Specifications, and Rules and Regulations can be found at www.MesaWater.org. A3-3

Regards,

Phil Lauri

Phil Lauri
Assistant General Manager
phill@mesawater.org
949.207.5469

2. Response to Comments

A3. RESPONSES TO COMMENTS FROM MESA WATER DISTRICT, MARCH 6, 2020.

A3-1 The commenter correctly states that the Mesa Water District (MWD) is the public agency responsible for the treatment and conveyance of potable water in the City, including the project site. All water improvements plans for the project are required to be submitted for plan check review and approval in order to receive a permit from MWD. This comment is acknowledged and supported in the Draft EIR Section 5.15, *Utilities and Service Systems*. As stated in the Draft EIR, any proposed public water systems within the project site would be located within an easement dedicated to MWD and would be subject to MWD's *Standard Specification and Standard Drawings for the Construction of Water Facilities* per Plans, Policies, Programs (PPP) USS-4. Compliance with Standard Condition of Approval (SCA) FIRE-24 would also ensure water mains and hydrants are installed to the standards of MWD and located within a dedicated MWD repair easement.

A3-2 The commenter states that a hydraulic model will be required to assess whether the existing potable water infrastructure in the project area is adequate to serve the proposed project without additional infrastructure improvements. A Preliminary Hydraulic Study was conducted and is included as Appendix F-1, *Preliminary Hydraulic Study*, in this Final EIR. The project's water demands for the proposed land uses and fire flow requirements are detailed in Table 2, *Project Water Demands*, and Table 3, *Required Fire Flow Summary*, of Appendix F-1. The Preliminary Hydraulic Study analyzed three scenarios: static pressure, maximum day demand, and maximum day demand plus fire flow. Under all three scenarios, the proposed water infrastructure improvements would adequately accommodate the project's water demand and fire flow demand by providing adequate system pressure to not drop below the minimum pounds-per-square-inch pressure thresholds for each scenario. As such, the Preliminary Hydraulic Study concluded that the estimated water demands of the project would not adversely impact MWD's existing distribution system, and no additional off-site improvements are necessary to serve the proposed development. Refer to Appendix F-1 for the full analysis.

It is acknowledged that the MWD would require a design-level hydraulic model to confirm the preliminary findings identified above as part of the permit process.

A3-3 A public scoping meeting for the proposed project was held on June 5, 2019 to solicit comments regarding the scope of the EIR. Further, Mesa Water District was notified on May 23, 2019 of the Notice of Preparation (NOP) for the EIR. Since this time, the City of Costa Mesa has been in contact with Mesa Water District regarding the EIR, including the Water Supply Assessment, which is documented in the Draft EIR. No additional scoping meetings will be held by the City as the Draft EIR has already been published for public review. Nevertheless, the City welcomes all responsible agencies and interested parties to attend public hearings regarding the proposed project.

DEPARTMENT OF TRANSPORTATION
DISTRICT 12
1750 E 4TH ST, SUITE 100
SANTA ANA, CA 92705
PHONE (657) 328-6000
FAX (657) 328-6511
TTY 711
www.dot.ca.gov

COMMENT LETTER A4

Making Conservation a California Way of Life.

March 16, 2020

Minoo Ashabi
City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

File: IGR/CEQA
SCH#: 2019050014
IGR Log: 2019-01322
I-405, PM: 12.128

Dear Ms. Ashabi:

Thank you for including the California Department of Transportation (Caltrans) in the review of the Draft Environmental Impact Report (DEIR) for the One Metro West Project. The proposed project is a mixed-use development that consists of residential, specialty retail, creative office, and open space uses. The project is proposed to include up to 1,057 multi-family rental residential dwelling units, 25,000 square feet of commercial (creative office) space, 6,000 square feet of specialty retail, and 1.5-acres of open space. All existing buildings, structures, parking areas, drive aisles, and hardscape/landscape improvements are proposed to be demolished. The project would also include off-site improvements to Sunflower Avenue and a bicycle trail connection to the Santa Ana River Trail. The 15.23-acre project is located at 1683 Sunflower Avenue in the city of Costa Mesa, Orange County. The nearest State facility to the project site is the Interstate 405 Freeway (I-405). A4-1

Caltrans is a responsible and commenting agency on this project and has the following comments:

Traffic Operations

1. Please update the document (page 26) and coordinate with the OC 405 Partners (I-405 Improvement Project) to obtain the latest final design Geometrics. In the latest design, eastbound slip-on ramp from Ellis Avenue to southbound I-405 has been changed to a triple left-turn lane from eastbound Ellis Avenue to the existing I-405 southbound on-ramp. Please revise the figures, tables, and analysis for the traffic volumes to include the latest final design and submit for review and comment. A4-2

2. Section 1.2.2 Freeway Analysis page 3 Traffic Impact Analysis – Please use a lower peak hour capacity of 2,300 vehicles per hour per lane for the freeway segments and submit for review and comment. A4-3

Environmental Planning

3. Please coordinate with the I-405 Improvement Project team for any schedule conflicts. The proposed project will be impacted by the following components of work under the I-405 Improvement Project:

   Northbound I-405 Freeway:
   a. I-405 Freeway segment, south of Fairview Road On-Ramp
   b. Fairview Road On-Ramp (merge)
   c. I-405 Freeway segment, between Fairview Road On-Ramp and Harbor Boulevard On-Ramp
   d. Harbor Boulevard On-Ramp (merge)
   e. I-405 Freeway segment, between Harbor Boulevard On-Ramp and Hyland Avenue On-Ramp
   f. Hyland Avenue On-Ramp (merge) A4-4

   Southbound I-405 Freeway:
   a. Harbor Boulevard Off-Ramp (diverge)
   b. I-405 Freeway segment, between Harbor Boulevard Off-Ramp and Harbor Boulevard Loop On-Ramp
   c. Harbor Boulevard Loop On-Ramp (merge)
   d. I-405 Freeway segment, between Harbor Boulevard Loop On-Ramp and Harbor Boulevard Slip-On
   e. Ramp
   f. Harbor Boulevard Slip-On Ramp (merge)
   g. I-405 Freeway segment, between Harbor Boulevard Slip-On Ramp and Fairview Road Off-Ramp (weave)

4. Some improvements under I-405 project would be completed prior to the proposed project's opening year. Therefore, these improvements have been considered as the intersection configuration under future short-term cumulative (2027) and A4-5

General Plan buildout (2040) conditions. However, some improvements on I-405 will still be underway. There are numerous changes to the ramp closures that should be considered for the proposed project. A4-5 cont'd

Encroachment Permit

5. In the event of any activity in Caltrans right of way an Encroachment Permit will be required. For specific details on Encroachment Permits procedure, please refer to Encroachment Permits Manual at: https://dot.ca.gov/programs/traffic-operations/ep A4-6

Please continue to keep us informed of this project and any future developments that could potentially impact State transportation facilities. If you have any questions or would like to meet with us regarding these comments, please do not hesitate to call Maryam Molavi at (657) 328-6280. A4-7

Sincerely,

SCOTT SHELLEY.
Branch Chief, Regional-IGR-Transit Planning

A4. RESPONSES TO COMMENTS FROM CALIFORNIA DEPARTMENT OF TRANSPORTATION, MARCH 16, 2020.

A4-1 This introductory comment provides a description of the California Department of Transportation's (Caltrans') responsibilities and a brief project description. No further response is required.

A4-2 The commenter states that the City should coordinate with the OC 405 Partners on the I-405 Improvement Project to obtain the latest final design geometrics and update the Traffic Impact Analysis to ensure consistency. The Traffic Impact Analysis has been updated an included as Appendix F-2, *Revised Traffic Impact Analysis*, in this Final EIR. All figures, tables, and analysis related to the latest I-405 Improvement Project design have been revised. None of the changes affect the results and findings of the original analysis. This response to this comment does not identify any significant new information and new impacts requiring recirculation. As such, recirculation of the Draft EIR is not required.

A4-3 The commenter requests that a lower peak hour capacity of 2,300 vehicles per hour per lane be utilized for the freeway segments in the Traffic Impact Analysis. The Traffic Impact Analysis prepared for the Draft EIR utilized the Highway Capacity Manual, 6th Edition. Peak hour capacities have been revised to 2,300 vehicles per hour per lane for the freeway segments. Impacts were identified at the same locations as disclosed in the Draft EIR. However, the timing of the impacts were modified as follows. Refer to Appendix F-2 of this Final EIR for the full Revised Traffic Impact Analysis.

Existing Plus Project

- Southbound – Harbor Boulevard Loop On-Ramp (Merge) are forecast to operate at a deficient LOS in both a.m. and p.m. peak hours (previously a.m. peak hour);

Future Short-Term Cumulative (2027) Baseline and Plus Project

- Northbound – Fairview Road On-Ramp (Merge) changes from satisfactory LOS to a deficient LOS (consistent with the impacts disclosed in the Draft EIR for the General Plan Buildout Baseline Plus Project scenario);
- Southbound – Harbor Boulevard Off-Ramp and Harbor Boulevard On-Ramp (Mainline Segment) changes from a deficient LOS to a satisfactory LOS in the p.m. peak hour;

General Plan Buildout (2040) Baseline

- Northbound – Harbor Boulevard On-Ramp (Merge) changes from a deficient LOS only in the p.m. peak hour to both a.m. and p.m. peak hours;

General Plan Build Out (2040) Baseline Plus Project

- Northbound – Harbor Boulevard On-Ramp (Merge) changes from a deficient LOS only in the p.m. peak hour to both a.m. and p.m. peak hours; and
- Southbound – Harbor Boulevard Loop On-Ramp and Harbor Boulevard Slip-On Ramp (Mainline Segment) changes from a deficient LOS in both a.m. and p.m. peak hours to a deficient LOS only in the a.m. peak hour.

This information shows that these clarifications do not affect the overall conclusions of the environmental document. These clarifications do not result in any new or substantially greater significant impacts as compared to those identified in the Draft EIR.

A4-4 The commenter requests the City coordinate with the I-405 Improvement Project team for any conflicts in construction schedules and identifies several components of work under the I-405 Improvement Project that would impact the proposed project. The comment is noted and the applicant would coordinate with Caltrans and the I-405 Improvement Project team prior to the start of construction activities to ensure there are no schedule conflicts with the I-405 Improvement Project activities.

A4-5 The commenter notes that some improvements proposed by the I-405 Improvement Project would still be underway under the Future Short-Term Cumulative (2027) (e.g., changes to ramp closures) that should be considered for the proposed project. This comment is acknowledged. However, while some I-405 Freeway improvements may still be underway at project completion (2027), all of the improvements would be completed by 2040, such that the General Plan Buildout (2040) scenario analyzes completion of the I-405 Improvement Project and adequately addresses all project-related impacts. In addition, the possible changes to ramp closures would be temporary conditions that are addressed and mitigated through the project's Construction Management Plan and through consultation with Caltrans, the I-405 Improvement Project team, and City's Transportation Division.

A4-6 The commenter states that in the event any work occurs within Caltrans right-of-way, it would require an Encroachment Permit. The commenter also provides a link to Caltrans' Encroachment Permits Manual for more details. At this time, no work is anticipated to occur in Caltrans right-of-way and no encroachment permit is anticipated. This comment is acknowledged and no further response is necessary as part of the CEQA process/CEQA response to comments.

A4-7 This concluding statement requests continued coordination with Caltrans for future developments that could impact State transportation facilities and provides contact information for questions. The City will continue to coordinate with Caltrans on future development projects.

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

SENT VIA E-MAIL: March 19, 2020
OMWPublicComments@costamesaca.gov
Minoo Ashabi, Principal Planner
City of Costa Mesa, Development Services Department
77 Fair Drive
Costa Mesa, CA 91716-0002

Draft Environmental Impact Report (Draft EIR) for the Proposed One Metro West Project (SCH No.: 2019050014)

South Coast Air Quality Management District (South Coast AQMD) staff appreciates the opportunity to comment on the above-mentioned document. The following comments are meant as guidance for the Lead Agency and should be incorporated into the Final EIR.

South Coast AQMD Staff's Summary of Project Description
The Lead Agency proposes to demolish an existing 345,000-square-foot industrial building and construct 1,057 residential units, 25,000 square feet of commercial uses, 6,000 square feet of retail uses, and 1.5 acres of open space on 15.23 acres (Proposed Project). The Proposed Project is located at 1683 Sunflower Avenue on the southeast corner of Sunflower Avenue and Cadilac Avenue within the City of Costa Mesa. Construction of the Proposed Project is anticipated to take place over a five-year period, from January 2022 to January 2027[1]. The Proposed Project will become operational as early as in year 2025, while construction activities continue[2], and will become fully operational in year 2027[3].

A5-1

South Coast AQMD Staff's Summary of the Air Quality Analysis
In the Draft EIR, the Lead Agency quantified the Proposed Project's construction emissions and compared those emissions to South Coast AQMD's recommended regional and localized air quality CEQA significance thresholds. The Lead Agency found that the Proposed Project's unmitigated regional construction air quality impacts would be significant for nitrogen oxide (NOx) emissions at 112 pounds per day (lbs/day) and volatile organic compounds (VOCs) emissions at 110 lbs/day[4]. The Lead Agency is committed to implementing construction Mitigation Measures (MMs) AIR-1 and AIR-2. MM AIR-1 requires all construction equipment 50 horsepower or more meet U.S. Environmental Protection Agency's (EPA) Tier 3 off-road emissions standards with Level 2 Diesel Particulate Filters (DPFs). MM AIR-2 requires that all interior architectural coatings meet a low VOC concentration of 30 grams per liter[5]. With implementation of MMs AIR-1 and AIR-2, the maximum regional construction NOx emissions would be reduced to less than significant at 92 lbs/day, while the maximum regional construction VOCs emissions would remain significant and unavoidable at 109 lbs/day[6]. The Lead Agency also quantified the Proposed Project's operational emissions in year 2027 when the Proposed Project is fully operational[7]. Based on the analyses, the Lead Agency found that the Proposed Project's operational air quality impacts would be less than significant[8]. As such, no mitigation measures for operational air quality impacts were required[9]. The

1 Draft EIR. Chapter 3. Project Description. Page 3-26.
2 *Ibid.*
3 Draft EIR. CalEEMod - One Metro West Summer Run. PDF page 163.
4 Draft EIR. Chapter 5.2. Air Quality. Page 5.2-21.
5 *Ibid*. Page 5.2-32.
6 *Ibid*. Page 5.2-33.
7 Draft EIR. CalEEMod - One Metro West Summer Run. PDF page 163.
8 Draft EIR. Chapter 5.2. Air Quality. Pages 5.2-23 through 5.2-24.
9 *Ibid.*

Proposed Project is located in close proximity with Interstate 405. As such, the Lead Agency requires the installation of enhanced filtration system with two-inch Minimum Efficiency Reporting Value (MERV) 13 filters as a project design feature[10]. Lastly, the Lead Agency included in the Draft EIR discussions on applicable South Coast AQMD rules[11], including Rule 403 – Fugitive Dust[12], Rule 1108 – Cutback Asphalt[13], Rule 1113 – Architectural Coatings[14], and Rule 1143 – Asbestos Emissions form Demolition[15].

<u>Summary of South Coast AQMD Staff's Comments</u>

Based on a review of the Draft EIR and supporting technical documents, South Coast AQMD staff has two main comments on the air quality analysis and mitigation measures. The Lead Agency likely underestimated the Proposed Project's air quality impacts because the Draft EIR did not analyze an overlapping construction and operation air quality impact scenario. The Lead Agency should strengthen the existing construction mitigation measure (MM AIR-1) and incorporate additional mitigation measures in the Final EIR to further reduce the Proposed Project's regional construction NOx emissions, particularly during periods of overlapping construction and operational activities. Please see the attachment for more information.

A5-1 cont'd

<u>Conclusion</u>

Pursuant to California Public Resources Code Section 21092.5(a) and CEQA Guidelines Section 15088(b), South Coast AQMD staff requests that the Lead Agency provide South Coast AQMD staff with written responses to all comments contained herein prior to the certification of the Final EIR. In addition, issues raised in the comments should be addressed in detail giving reasons why specific comments and suggestions are not accepted. There should be good faith, reasoned analysis in response. Conclusory statements unsupported by factual information will not suffice (CEQA Guidelines Section 15088(c)). Conclusory statements do not facilitate the purpose and goal of CEQA on public disclosure and are not meaningful, informative, or useful to decision makers and to the public who are interested in the Proposed Project. Further, if the Lead Agency makes the findings that the recommended revisions to MM AIR-1 and new mitigation measures are not feasible, the Lead Agency should describe the specific reasons supported by substantial evidence for rejecting them in the Final EIR (CEQA Guidelines Section 15091). South Coast AQMD staff is available to work with the Lead Agency to address any air quality questions that may arise from this comment letter. Please contact Alina Mullins, Assistant Air Quality Specialist, at amullins@aqmd.gov or (909) 396-2402 if you have questions or wish to discuss the comments.

Sincerely,

Lijin Sun

Lijin Sun, J.D.
Program Supervisor, CEQA IGR
Planning, Rule Development & Area Sources

Attachment
LS:AM
<u>ORC200207-01</u>
Control Number

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[10] Draft EIR. Chapter 5.9. Land Use and Planning. Page 5.9-13.

[11] *Ibid*. Pages 5.2-6 through 5.2-11.

[12] South Coast AQMD. Rule 403 – Fugitive Dust. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-403.pdf.

[13] South Coast AQMD. Rule 1108 – Cutback Asphalt. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1108-cutback-asphalt.pdf.

[14] South Coast AQMD. Rule 1143 – Architectural Coatings. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1143.pdf

[15] South Coast AQMD. Rule 1403 – Asbestos Emissions form Demolition. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1403.pdf

ATTACHMENT

1. **Air Quality Analysis – Overlapping Construction and Operational Activities**

Based on a review of the Air Quality Analysis in the Draft EIR, South Coast AQMD staff found that the Lead Agency did not analyze a scenario where construction activities overlap with operational activities (e.g., some components of the Proposed Project may be operational in year 2025 while some other components are under construction until year 2027). Since construction of the Proposed Project is expected to occur over five years from 2022 to 2027, and the Proposed Project will be operational as early as 2025[16], it is reasonably foreseeable that construction and operation may overlap. If an overlapping construction and operation scenario is reasonably foreseeable at the time the Draft EIR was prepared, to conservatively analyze a worst-case impact scenario, South Coast AQMD staff recommends that the Lead Agency use its best efforts to identify the overlapping construction and operational years and development components, combine construction emissions (including emissions from demolition) with operational emissions, and compare the combined emissions to South Coast AQMD's air quality CEQA *operational* thresholds of significance to determine the level of significance in the Final EIR. If the air quality analysis from overlapping construction and operational activities is not included in the Final EIR, the Lead Agency should provide reasons for not including the analysis supported by substantial evidence in the record. A5-2

2. **Air Quality Mitigation Measures**

2.1 Recommended Revisions to Existing Air Quality Mitigation Measure (MM) AIR-1

CEQA requires that all feasible mitigation measures that go beyond what is required by law be utilized to minimize or eliminate any significant adverse air quality impacts. With the implementation of MM AIR-1, which requires all construction equipment 50 horsepower or more during grading meet EPA's Tier 3 off-road emissions standards with Level 2 DPFs, the maximum regional construction NOx emissions at 92 lbs/day would be slightly below South Coast AQMD's regional air quality CEQA significance threshold for NOx at 100 lbs/day during construction. To further reduce NOx emissions, particularly during the periods when construction and operational activities overlap, the Lead Agency should strengthen MM AIR-1 by making the following revisions in strikethrough and underline in the Final EIR.

AIR-1 A5-3

Prior to the issuance of a grading permit, ~~the grading~~ all construction plans shall stipulate that the contractor shall use construction equipment that meets or exceeds the U.S. Environmental Protection Agency Tier ~~3~~ 4 Final level of emission controls fitted with Level ~~2~~ 3 Diesel Particulate Filters (DPF) for all construction equipment 50 horsepower or more during construction activities. Level 3 DPFs are capable of achieving at least 85 percent reduction in particulate matter emissions[17]. A list of CARB verified DPFs are available on the CARB website[18].

To ensure that Tier 4 Final construction equipment or better would be used during the Proposed Project's construction, South Coast AQMD staff recommends that the Lead Agency include this requirement in applicable bid documents, purchase orders, and contracts. Successful contractor(s) must demonstrate the ability to supply the compliant construction equipment for use prior to any

[16] Draft EIR. Chapter 3. Project Description. Page 3-26.
[17] CARB. November 16-17, 2004. *Diesel Off-Road Equipment Measure – Workshop*. Page 17. Accessed at: https://www.arb.ca.gov/msprog/ordiesel/presentations/nov16-04_workshop.pdf.
[18] *Ibid*. Page 18.

ground disturbing and construction activities. A copy of each unit's certified tier specification or model year specification and CARB or South Coast AQMD operating permit (if applicable) shall be available upon request at the time of mobilization of each applicable unit of equipment. Additionally, the Lead Agency should require periodic reporting and provision of written construction documents by construction contractor(s) to ensure compliance, and conduct regular inspections to the maximum extent feasible to ensure compliance. A5-3 cont'd

In the event that construction equipment cannot meet the Tier 4 Final engine certification, the Project representative or contractor must demonstrate through future study with written findings supported by substantial evidence that is approved by the Lead Agency before using other technologies/strategies. Alternative applicable strategies may include, but would not be limited to, construction equipment with Tier 4 Interim emission standards and/or reduction in the number and/or horsepower rating of construction equipment.

2.2 Additional Recommended Air Quality Mitigation Measures

In the event that, upon revisions to the Air Quality Analysis based on Comment No. 1, the Lead Agency finds that the Proposed Project will have significant air quality impacts from overlapping construction and operational activities, mitigation will be required (CEQA Guidelines 15126.4). South Coast AQMD staff has compiled a list of additional mitigation measures as suggested resources and guidance to the Lead Agency and recommends that the Lead Agency incorporate them in the Final EIR. For more information on potential mitigation measures as guidance to the Lead Agency, please visit South Coast AQMD's CEQA Air Quality Handbook website[19].

Construction-related Air Quality Mitigation Measures

a) Require construction equipment such as concrete/industrial saws, pumps, aerial lifts, material hoist, air compressors, forklifts, excavator, wheel loader, and soil compactors be electric or alternative-fueled (i.e., non-diesel). Information on companies and electric powered equipment that can and should be used during construction is available at: https://www.forconstructionpros.com/construction-technology/article/21107531/electrified-construction-equipment-gaining-momentum. A5-4

b) Require the use of zero-emissions (ZE) or near-zero emissions (NZE) on-road haul trucks (e.g., material delivery trucks and soil import/export) such as heavy-duty trucks with natural gas engines that meet CARB's adopted optional NOx emission standard at 0.02 grams per brake horsepower-hour (g/bhp-hr), or at a minimum, 2010 model year[20] or newer and cleaner engines that meet California Air Resources Board's (CARB) 2010 engine emission standards of 0.01 g/bhp-hr for particulate matter (PM) and the CARB's adopted optional NOx emission standard of 0.20 g/bhp-hr for NOx emissions during construction. When requiring electric ZE heavy-duty trucks, the Lead Agency should include analyses to evaluate and identify sufficient power and supportive infrastructure available in the Energy and Utilities and Service Systems Chapters of the Final EIR, where appropriate.

[19] South Coast Air Quality Management District. Accessed at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook.

[20] CARB adopted the statewide On-Road Truck and Bus Regulation in 2010. The Regulation requires diesel trucks and buses that operate in California to be upgraded to reduce emissions. Newer heavier trucks and buses must meet particulate matter filter requirements beginning January 1, 2012. Lighter and older heavier trucks must be replaced starting January 1, 2015. By January 1, 2023, nearly all trucks and buses will need to have 2010 model year engines or equivalent. More information on the CARB's Truck and Bus Regulations is available here: https://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm.

NZE heavy-duty truck engines are commercially available. Examples of commercially available NZE heavy-duty truck engines that meet CARB optional low NOx standards include, but are not limited to, Cummins Westport 8.9- and 6.7-liter natural gas engines and Roush Cleantech 6.8-liter compressed natural gas and liquefied petroleum gas engines[21]. Therefore, NZE heavy-duty trucks should be required for use during construction.

If the specific details regarding ZE heavy-duty trucks are impractical or infeasible to include in the Final EIR, the Lead Agency should develop and include performance standards to achieve the use of ZE heavy-duty trucks (CEQA Guidelines Section 15126.4(a)). The Lead Agency can and should develop the following performance standards or any other comparable standards.

- Develop a minimum amount of ZE heavy-duty trucks that the Proposed Project must use each year during construction to ensure adequate progress. Include this requirement in the Proposed Project's Construction Management Plan.

- Establish a contractor(s) selection policy that prefers contractor(s) who can supply ZE heavy-duty trucks during construction. Include this policy in the Request for Proposal for selecting contractor(s).

To monitor and ensure ZE, NZE, or 2010 model year trucks are used at the Proposed Project, the Lead Agency should require that operators maintain records of all trucks associated with the Proposed Project's construction and make these records available to the Lead Agency upon request. The records will serve as evidence to prove that each truck called to the Proposed Project during construction meets the minimum 2010 model year engine emission standards. Alternatively, the Lead Agency should require periodic reporting and provision of written records by contractors and conduct regular inspections of the records to the maximum extent feasible and practicable. A5-4 cont'd

c) Maintain equipment maintenance records for the construction portion of the Proposed Project. All construction equipment must be tuned and maintained in compliance with the manufacturer's recommended maintenance schedule and specifications. All maintenance records for each equipment and their construction contractor(s) should be made available for inspection and remain on-site for a period of at least two years from completion of construction.

d) Encourage construction contractors to apply for South Coast AQMD "SOON" funds. The "SOON" program provides funds to applicable fleets for the purchase of commercially-available low-emission heavy-duty engines to achieve near-term reduction of NOx emissions from in-use off-road diesel vehicles. More information on this program can be found at South Coast AQMD's website: http://www.aqmd.gov/home/programs/business/business-detail?title=off-road-diesel-engines.

e) Utilize water-based or low VOCs architectural coatings that go beyond the requirements of South Coast AQMD Rule 1113. Utilize pre-coated building materials during building construction, as feasible.

[21] CARB. "Optional Reduced NOx Emissions Standards for On-Road Heavy-duty Engines". Accessed at: https://ww3.arb.ca.gov/msprog/onroad/optionnox/optionnox.htm

Operation-related Air Quality Mitigation Measures

f) Require the use of zero-emissions (ZE) or near-zero emissions (NZE) on-road haul trucks (e.g., vendors and material delivery trucks) such as heavy-duty trucks with natural gas engines that meet CARB's adopted optional NOx emission standard at 0.02 grams per brake horsepower-hour (g/bhp-hr), or at a minimum, 2010 model year[22] or newer and cleaner engines that meet California Air Resources Board's (CARB) 2010 engine emission standards of 0.01 g/bhp-hr for particulate matter (PM) and the CARB's adopted optional NOx emission standard of 0.20 g/bhp-hr for NOx emissions during construction. Since NZE heavy-duty trucks are already commercially available, the Lead Agency should require the use of ZE heavy-duty trucks during operation in the Final EIR.

g) Establish a policy to select and use vendors that use ZE heavy-duty trucks. Include this policy in the vendor contracts and business agreements. A5-4 cont'd

h) Establish a purchasing policy to purchase and receive materials from vendors that use ZE heavy-duty trucks to deliver materials. Include this policy in the purchase orders with vendors.

i) Develop a target-focused and performance-based process and timeline to implement the use of ZE heavy-duty trucks during operation.

j) Develop a project-specific process and criteria for periodically assessing progress in implementing the use of ZE heavy-duty trucks during operation.

[22] CARB adopted the statewide On-Road Truck and Bus Regulation in 2010. The Regulation requires diesel trucks and buses that operate in California to be upgraded to reduce emissions. Newer heavier trucks and buses must meet particulate matter filter requirements beginning January 1, 2012. Lighter and older heavier trucks must be replaced starting January 1, 2015. By January 1, 2023, nearly all trucks and buses will need to have 2010 model year engines or equivalent. More information on the CARB's Truck and Bus Regulations is available here: https://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm.

A5. RESPONSES TO COMMENTS FROM SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT, MARCH 19, 2020.

A5-1 This comment is the cover letter to South Coast Air Quality Management District's (SCAQMD) comments on the Draft EIR. The comment provides a summary of the project description, air quality analysis, and recommended mitigation measures included in the Draft EIR. The comment also references an attachment of staff comments on the air quality analysis and mitigation measures. The cover letter requests the City provide written responses to all comments contained in the comment letter. This comment is acknowledged; responses to specific comments within this letter are provided below.

A5-2 The commenter states that the air quality analysis in the Draft EIR does not analyze a scenario in which construction activities overlap with operational activities. If an overlapping construction and operation scenario is reasonably foreseeable, the SCAQMD requests additional air quality analysis from overlapping activities to be included. The Draft EIR incorrectly states that first occupancy of the proposed development would occur in 2025. Project occupancy would only occur after all construction is complete in 2027. This error is corrected in Chapter 3, *Errata*, of this Final EIR and an analysis considering a scenario where construction activities overlap with operational activities is not required.

A5-3 The commenter states that implementation of Mitigation Measure AIR-1 would reduce project-generated construction nitrous oxide (NO_X) emissions to 92 pounds per day, slightly below the SCAQMD's 100-pounds per day threshold, and suggests revisions to Mitigation Measure AIR-1 to further reduce NO_X emissions. As shown in Draft EIR Table 5.2-15, *Short-Term Regional Peak Day Construction Emissions with Mitigation*, implementation of Mitigation Measure AIR-1 would reduce the short-term regional NO_X emissions to a less than significant level. Therefore, additional mitigation measures or revisions to Mitigation Measure AIR-1 that would provide more stringent requirements as suggested by the commenter are not required.

The commenter also suggests utilizing water-based or low volatile organic compound (VOC) architectural coatings that go beyond the requirements of SCAQMD Rule 1113 and utilizing pre-coated building materials during building construction, as feasible. Use of "Zero VOC" paints (i.e., coatings with less than 5 grams of VOC per liter) is not feasible because these paints are limited to brush-type application rather than spray and it would not be feasible to paint all of the project's proposed buildings and structures by brush. "Low VOC" paints (i.e., coatings with less than 50 grams of VOC per liter) are the best available paints that can be sprayed. Mitigation Measure AIR-2 already requires the use of paints with low VOC content with a maximum concentration of 30 grams per liter. It should be noted that the CalEEMod output files provided in the Draft EIR incorrectly omitted implementation of Mitigation Measure AIR-2 in the mitigated model run. Remodeling of the mitigated construction emissions shows that VOC emissions would be reduced to 78 pounds per day, which would continue to exceed the SCAQMD's 75 pounds per day threshold; refer to Appendix F-3, *Mitigated Air Quality Modeling Sheets*. Thus, impacts in this regard would remain the same as analyzed in the Draft EIR. Additionally, utilizing pre-coated building materials (i.e., prefabricated materials) to avoid the need for subsequent architectural coating is not feasible given the scale of the project (e.g., four large buildings ranging from three to seven stories in height).

A5-4 The commenter provides a list of additional mitigation measures as suggested resources and guidance to incorporate into the Draft EIR should the air quality analysis of overlapping construction and operational activities (requested in comment A5-2) result in potentially significant impacts. As stated, the project would be constructed in one phase and occupancy would not occur prior to full completion of the project. Additionally, as shown in Table 5.2-11, *Opening Year Regional Operational Emissions*, of the Draft EIR, the proposed project would not exceed the SCAQMD operational thresholds. In addition, Mitigation Measure AIR-1 would reduce construction-related emissions of NO_X to a less than significant level. Therefore, additional mitigation measures as suggested in this comment are not required.

OCTA

March 23, 2020

Mr. Minoo Ashabi
Principal Planner
City of Costa Mesa
Development Services Department
77 Fair Drive
Cosa Mesa, CA 92626

Subject: **Notice of Availability of a Draft Environmental Impact Report for the One Metro West Project**

Dear Mr. Ashabi:

Thank you for providing the Orange County Transportation Authority (OCTA) with a copy of the Notice of Availability of a Draft Environmental Impact Report for the One Metro West Project. The following comments are provided for your consideration: A6-1

- Please note that the City of Santa Ana is planning to update their General Plan, including the Circulation Element, to support safety and Complete Streets projects. Please coordinate with the City of Santa Ana as appropriate.

- Page ii "Acronyms and Abbreviations" identifies the "CMP" as the Congestion Management "Plan". Please revise this and all additional document references to Congestion Management "Program."

Throughout the development of this project, we encourage communication with OCTA on any matters discussed herein. If you have any questions or comments, please contact me at (714) 560-5907 or at dphu@octa.net. A6-2

Sincerely,

Dan Phu
Manager, Environmental Programs

A6. RESPONSES TO COMMENTS FROM ORANGE COUNTY TRANSPORTATION AUTHORITY, MARCH 23, 2020.

A6-1 The commenter notes that the City of Santa Ana is planning to update its General Plan, including the Circulation Element, to support safety and Complete Streets projects and that the City of Costa Mesa should coordinate with the City of Santa Ana, as appropriate. This comment is acknowledged; no further response is necessary as part of the CEQA process/CEQA response to comments.

A6-2 The commenter identifies a typographical error in the Draft EIR regarding the Congestion Management Program (CMP) and suggests revising this language where applicable. This typographical error is corrected in Chapter 3, *Errata*, of this Final EIR.

The commenter also encourages communication with the Orange County Transportation Authority throughout the development of the proposed project. This comment is acknowledged and the City will continue sending future CEQA notices regarding the proposed project to the Orange County Transportation Authority; no further response is necessary as part of the CEQA process/CEQA response to comments.

ORANGE COUNTY OC Public Works

March 23, 2020

NCL-19-043

Minoo Ashabi, Principal Planner
City of Costa Mesa
Development Services Department
77 Fair Drive
Costa Mesa, CA 92626

Subject: Notice of Availability for a Draft Environmental Impact Report for the One Metro West Project (State Clearinghouse No. 2019050014)

Dear Ms. Ashabi,

The County of Orange has reviewed the Draft Environmental Impact Report for the One Metro West Project and has no comments at this time. We would like to be advised of further developments on the project. Please continue to keep us on the distribution list for future notifications related to the project. A7-1

If you have any questions regarding these comments, please contact Cindy Salazar at (714) 667-8870 in OC Development Services.

Sincerely,

Richard Vuong, Manager, Planning Division
OC Public Works Service Area/OC Development Services
601 North Ross Street
Santa Ana, California 92701
Richard.Vuong@ocpw.ocgov.com

A7. RESPONSES TO COMMENTS FROM ORANGE COUNTY PUBLIC WORKS, MARCH 23, 2020.

A7-1 The commenter acknowledges that Orange County Public Works staff have no comments on the Draft EIR, but requests to continue receiving notices regarding the proposed development. This comment is acknowledged and the City will continue sending future CEQA notices regarding the proposed project to the Orange County Public Works.

From: Gonzalez Romero, Arysa (TRBL) [mailto:aromero@aguacaliente.net]
Sent: Tuesday, February 18, 2020 3:54 PM
To: OMW Public Comments <OMWPublicComments@costamesaca.gov>
Subject: One Metro West Project State Clearinghouse No. 2019050014

Greetings,

A records check of the Tribal Historic preservation office's cultural registry revealed that this project is not located within the Tribe's Traditional Use Area. Therefore, we defer to the other tribes in the area. This letter shall conclude our consultation efforts. T1-1

Thank you,

Arysa Gonzalez Romero
Historic Preservation Technician
Agua Caliente Band of Cahuilla Indians
5401 Dinah Shore Drive Palm Springs, CA 92264
D: 760-883-1327 | C: 760-831-2484

T1. RESPONSES TO COMMENTS FROM AGUA CALIENTE BAND OF CAHUILLA INDIANS, FEBRUARY 18, 2020.

T1-1 The commenter states that the project site is not located within the Agua Caliente Band of Cahuilla Indians' Traditional Use Area and thus, concludes the tribe's consultation efforts and defers to other tribes in the area. This comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments.

COMMENT LETTER T2

Rincon Band of Luiseño Indians

One Government Center Lane | Valley Center | CA 92082
(760) 749-1051 | Fax: (760) 749-8901 | rincon-nsn.gov

February 20, 2020

Minoo Ashabi
City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

Re: One Metro West

Dear Minoo Ashabi:

This letter is written on behalf of the Rincon Band of Luiseño Indians. Thank you for inviting us to submit comments on the above mention project. Rincon is submitting these comments concerning your projects potential impact on Luiseño cultural resources.

The Rincon Band has concerns for the impacts to historic and cultural resources and the finding of items of significant cultural value that could be disturbed or destroyed and are considered culturally significant to the Luiseño people. This is to inform you; your identified location is not within the Luiseño Aboriginal Territory. We recommend that you locate a tribe within the project area to receive direction on how to handle any inadvertent findings according to their customs and traditions. T2-1

If you would like information on tribes within your project area, please contact the Native American Heritage Commission and they will assist with a referral.

Thank you for the opportunity to protect and preserve our cultural assets.

Sincerely,

Deneen Pelton

Deneen Pelton, Administrative Assistant for
Cheryl Madrigal, M.A.
Cultural Resources Manager
Cultural Resources Department
Office: 760-297-2635 ext. 318|Cell: 760-648-3000
Email: cmadrigal@rincon-nsn.gov

T2. RESPONSES TO COMMENTS FROM RINCON BAND OF LUISEÑO INDIANS, FEBRUARY 20, 2020.

T2-1 The commenter states that the project site is not located within the Luiseño Aboriginal Territory and recommends the City contact a tribe with traditional use areas encompassing the project site to properly evaluate potential project impacts on cultural and tribal cultural resources. As detailed in Section 5.14, *Tribal Cultural Resources*, of the Draft EIR, in compliance with Senate Bill 18 (SB 18) and Assembly Bill 52 (AB 52), the City has notified Native American contacts provided by the Native American Heritage Commission and formally invited tribes to consult with the City on the proposed project.

GABRIELENO BAND OF MISSION INDIANS - KIZH NATION
Historically known as The San Gabriel Band of Mission Indians
recognized by the State of California as the aboriginal tribe of the Los Angeles basin

Project Name: One Metro West Project located at 1683 Sunflower Avenue in the City of Costa Mesa, Orange County

Dear Minoo Ashabi,

Thank you for your letter dated February 7, 2020 regarding AB52 consultation. The above proposed project location is within our Ancestral Tribal Territory; therefore, our Tribal Government requests to schedule a consultation with you as the lead agency, to discuss the project and the surrounding location in further detail. T3-1

Please contact us at your earliest convenience. ***Please Note:AB 52, "consultation" shall have the same meaning as provided in SB 18 (Govt. Code Section 65352.4).***

Thank you for your time,

Andrew Salas, Chairman
Gabrieleno Band of Mission Indians – Kizh Nation
1(844)390-0787

APPENDIX 1: Map 1-2; Bean and Smith 1978 map.

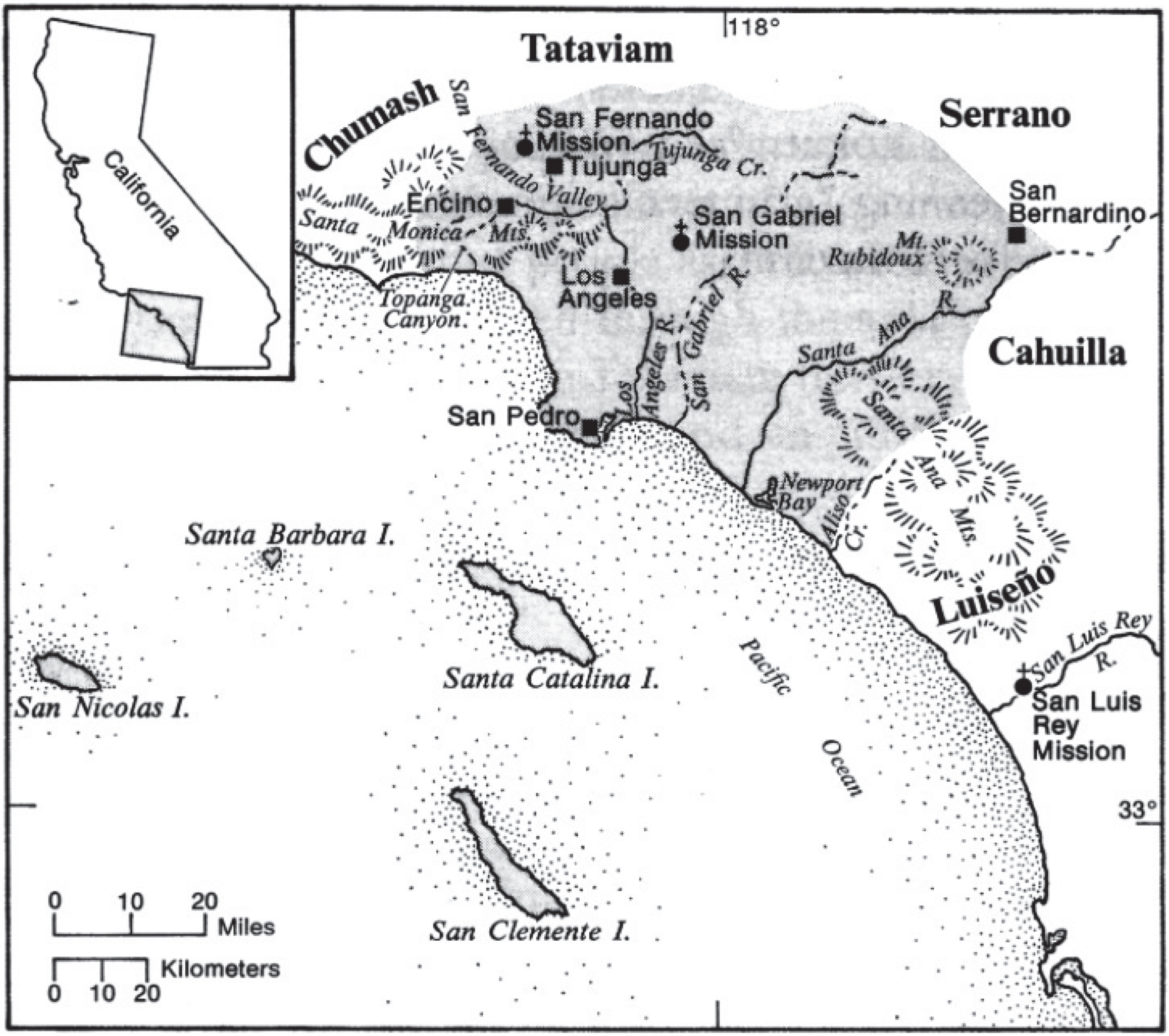

Fig. 1. Tribal territory.

The United States National Museum's Map of Gabrielino Territory:

Bean, Lowell John and Charles R. Smith
1978 Gabrielino IN *Handbook of North American Indians, California,* Vol. 8, edited by R.F. Heizer, Smithsonian Institution Press, Washington, D.C., pp. 538-549

T3. RESPONSES TO COMMENTS FROM GABRIELENO BAND OF MISSION INDIANS – KIZH NATION, FEBRUARY 21, 2020.

T3-1 The commenter incorrectly identifies the Notice of Availability, dated February 7, 2020, as an AB 52 notification letter, and requests to schedule a consultation with the City. As detailed in Section 5.14, *Tribal Cultural Resources*, of the Draft EIR, the City sent SB 18/AB 52 notification letters to applicable tribes, including the Gabrieleno Band of Mission Indians – Kizh Nation, formally inviting tribes to consult with the City on the proposed project. The Gabrieleno Band of Mission Indians – Kizh Nation (Andrew Salas, Chairperson) responded to the City's request for consultation. The City conducted a formal consultation via conference call with Andrew Salas on August 20, 2019. Mr. Salas indicated there was a high potential to encounter unknown buried tribal cultural resources due to the project's proximity to a sacred village (Lupukunga), a historical water course (Santa Ana River), and a major traditional trade route (the Southern Pacific Railroad). Thus, Mitigation Measure TCR-1 was included in the Draft EIR to ensure a qualified Native American Monitor is present during excavation activities involving native soils. If evidence of potential subsurface tribal cultural materials is found during site disturbance/excavation activities and the qualified archaeologist/Native American Monitor determines that the find is prehistoric or includes Native American materials, Mitigation Measure TCR-1 would ensure affiliated Native American groups are invited to contribute to the assessment and recovery of the found resource. With implementation of Mitigation Measure TCR-1, impacts would be reduced to less than significant levels. Consultation concluded with the City and the Gabrieleno Band of Mission Indians – Kizh Nation.

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F: (626) 389-5414
E: mitch@mitchtsailaw.com

Mitchell M. Tsai
Attorney At Law

155 South El Molino Avenue
Suite 104
Pasadena, California 91101

VIA U.S. MAIL & E-MAIL

March 23, 2020

Via E-Mail & U.S. Mail

Attn: One Metro West Draft EIR
Minoo Ashabi, Principal Planner
City of Costa Mesa
Development Services Department
77 Fair Drive
Costa Mesa, CA 92626
Em: OMWPublicComments@costamesaca.gov

RE: One Metro West Project, State Clearinghouse No. 2019050014

Dear Ms. Ashabi,

On behalf of the Southwest Regional Council of Carpenters ("**Commenters**" or "**Carpenters**"), my Office is submitting these comments on the City of Costa Mesa ("**City**" or "**Lead Agency**") Draft Environmental Impact Report ("**DEIR**") (SCH No. 2019050014) for the One Metro West Project, a proposed "mixed-use development that consists of residential, specialty, retail, creative office, and open space uses." "The project is proposed to include up to 1,057 residential dwelling units (anticipated rental units), 25,000 square feet of commercial creative office, 6,000 square feet of specialty retail, and 1.5 acres of open space." ("**Project**").

The Southwest Carpenters is a labor union representing 50,000 union carpenters in six states, including in southern California, and has a keen interest in well-ordered land use planning and addressing the environmental impacts of development projects. O1-1

Commenter expressly reserves the right to supplement these comments at or before hearings on the Project, and at any later hearings and proceedings related to this Project. Cal. Gov. Code § 65009(b); Cal. Pub. Res. Code § 21177(a); *Bakersfield Citizens for Local Control v. Bakersfield* (2004) 124 Cal. App. 4th 1184, 1199-1203; see *Galante Vineyards v. Monterey Water Dist.* (1997) 60 Cal. App. 4th 1109, 1121.

Commenter incorporates by reference all comments raising issues regarding the EIR submitted before certification of the EIR for the Project. *Citizens for Clean Energy v City of Woodland* (2014) 225 CA4th 173, 191 (finding that any party who has objected to the Project's environmental documentation may assert any issue timely raised by other parties).

Moreover, Commenter requests that the Lead Agency provide notice for all notices referring or related to the Project issued under the California Environmental Quality Act ("**CEQA**"), Cal Public Resources Code ("**PRC**") § 21000 *et seq*, and the California Planning and Zoning Law ("**Planning and Zoning Law**"), Cal. Gov't Code §§ 65000–65010. California Public Resources Code Sections 21092.2, and 21167(f) and Government Code Section 65092 require agencies to mail such notices to any person who has filed a written request for them with the clerk of the agency's governing body. O1-1 cont'd

I. THE PROJECT WOULD BE APPROVED IN VIOLATION OF THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

A. Background Concerning the California Environmental Quality Act

CEQA has two basic purposes. First, CEQA is designed to inform decision-makers and the public about the potential, significant environmental effects of a project. 14 California Code of Regulations ("**CCR**" or "**CEQA Guidelines**") § 15002(a)(1). "Its purpose is to inform the public and its responsible officials of the environmental consequences of their decisions *before* they are made. Thus, the EIR 'protects not only the environment but also informed self-government.' [Citation.]" *Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal. 3d 553, 564. The EIR has been described as "an environmental 'alarm bell' whose purpose it is to alert the public and its responsible officials to environmental changes before they have reached ecological points of no return." *Berkeley Keep Jets Over the Bay v. Bd. of Port Comm'rs.* (2001) 91 Cal. App. 4th 1344, 1354 ("*Berkeley Jets"*); *County of Inyo v. Yorty* (1973) 32 Cal.App.3d 795, 810. O1-2

Second, CEQA directs public agencies to avoid or reduce environmental damage when possible by requiring alternatives or mitigation measures. CEQA Guidelines § 15002(a)(2) and (3). *See also, Berkeley Jets,* 91 Cal. App. 4th 1344, 1354; *Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553; *Laurel Heights Improvement Ass'n v. Regents of the University of California* (1988) 47 Cal.3d 376, 400. The EIR serves to provide public agencies and the public in general with information about the effect that a proposed project is likely to have on the environment and to "identify ways that environmental damage can be avoided or significantly reduced." CEQA Guidelines § 15002(a)(2). If the Project has a significant effect on the environment, the agency may approve the Project only upon finding that it has "eliminated or substantially lessened all significant effects on the environment where feasible," and that any significant unavoidable effects on the environment are "acceptable due to overriding concerns" specified in CEQA section 21081. CEQA Guidelines § 15092(b)(2)(A–B).

While the courts review an EIR using an "abuse of discretion" standard, "the reviewing court is not to 'uncritically rely on every study or analysis presented by a project proponent in support of its position.' A 'clearly inadequate or unsupported study is entitled to no judicial deference.'" *Berkeley Jets*, 91 Cal.App.4th 1344, 1355 (emphasis added) (quoting *Laurel Heights,* 47 Cal.3d at 391, 409 fn. 12). Drawing this line and determining whether the EIR complies with CEQA's information disclosure requirements presents a question of law subject to independent review by the courts. (*Sierra Club v. Cnty. of Fresno* (2018) 6 Cal. 5th 502, 515; *Madera Oversight Coalition, Inc. v. County of Madera* (2011) 199 Cal.App.4th 48, 102, 131.)As the court stated in *Berkeley Jets*, 91 Cal. App. 4th at 1355: O1-2 cont'd

> A prejudicial abuse of discretion occurs "if the failure to include relevant information precludes informed decision-making and informed public participation, thereby thwarting the statutory goals of the EIR process.

The preparation and circulation of an EIR are more than a set of technical hurdles for agencies and developers to overcome. The EIR's function is to ensure that government officials who decide to build or approve a project do so with a full understanding of the environmental consequences and, equally important, that the public is assured those consequences have been considered. For the EIR to serve these goals, it must present information so that the foreseeable impacts of pursuing the Project can be understood and weighed, and the public must be given an adequate opportunity to comment on that presentation before the decision to go forward is made. *Communities for a Better Environment v. Richmond* (2010) 184 Cal. App. 4th 70, 80 (quoting *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 449–450).

B. The DEIR Does Not Adequately Describe the Project

An EIR must be "prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences." *Dry Creek Citizens Coalition v. County of Tulare* (1999) 70 Cal.App.4th 20, 26. An EIR's description of the Project should identify the Project's main features and other information needed for an assessment of the Project's environmental impacts. *Citizens for a Sustainable Treasure Island v City & County of San Francisco* (2014) 227 Cal.App.4th 1036, 1053.

The DEIR fails to describe the specific land use entitlements that the Project will be seeking. The DEIR lists required entitlements from various state and local agencies, but indicates that the list is non-exhaustive and that the entitlements listed are "in addition to" non-descript "ministerial actions such as demolition permit, grading permit, building permits, certificates of occupancy, etc." DEIR, p. 3-27. O1-3

Among the listed entitlements required are amendments to the General Plan, Specific Plan, and Master Plan, as well as a change in zoning. However, the Project fails to describe these listed changes. Without further detail as to what these amendments entail, as well as the extent of the ministerial actions, the Project fails to provide a sufficient description upon which to evaluate the Project's potential land use impacts.

C. The DEIR Must Describe All Feasible Mitigation Measures That Can Minimize the Project's Significant and Unavoidable Environmental Impacts

A fundamental purpose of an EIR is to identify ways in which a proposed project's significant environmental impacts can be mitigated or avoided. Pub. Res. Code §§ 21002.1(a), 21061. To implement this statutory purpose, an EIR must describe any feasible mitigation measures that can minimize the Project's significant environmental effects. PRC §§ 21002.1(a), 21100(b)(3); CEQA Guidelines §§ 15121(a), 15126.4(a).

If the Project has a significant effect on the environment, the agency may approve the Project only upon finding that it has "eliminated or substantially lessened all significant effects on the environment where feasible"[1] and find that 'specific overriding economic, legal, social, technology or other benefits of the project outweigh the significant effects on the environment."□ "A gloomy forecast of environmental O1-4

[1] PRC §§ 21002; 21002.1, 21081; CEQA Guidelines §§ 15091, 15092(b)(2)(A).

degradation is of little or no value without pragmatic, concrete means to minimize the impacts and restore ecological equilibrium." *Environmental Council of Sacramento v. City of Sacramento* (2006) 142 Cal.App.4th 1018, 1039. O1-4 cont'd

1. The DEIR Does Not Mitigate The Project's Significant and Unavoidable Greenhouse Gas Emissions

The DEIR concludes that the Project will have significant Greenhouse Gas (GHG) emissions impacts since the estimated total emissions from the Project's construction and operation and mobile sources will exceed the SCAQMD threshold. DEIR, 4.5-12. But the DEIR explains that there are no additional feasible mitigation measures beyond those that the DEIR current proposal that would reduce GHG emissions to levels that are less than significant, DEIR 5.6-16. This explanation is untrue.

The only two proposed mitigation measures, GHG-1 and GHG-2, suggest merely to ensure that the Project is designed so that the parking areas provide <u>the minimum</u> number of electric vehicle charging stations required by the State's Green Building Standards Code Sections A5.106.5.1.2 and A5.106.5.3.2, which require only 12% of total designated parking spaces be used for low-emitting, fuel-efficient, and carpool/vanpool vehicles. Since the DEIR premises its GHG mitigation upon providing a minimum of EV parking spaces, and potentially more, the DEIR implicitly concedes that additional mitigation is possible.

These are not the only feasible means of mitigating GHG emissions. In particular, the CEQA Guidelines require mitigation measures that go far beyond the Project providing a minimum number of electric vehicle charging stations, requiring that an EIR consider: O1-5

(1) Steps in an existing plan or mitigation program for the reduction of emissions that are required as part of the lead agency's decision;

(2) Reductions in emissions resulting from a project through implementation of project features, project design, or other measures, such as those described in Appendix F;

(3) Off-site measures, including offsets that are not otherwise required, to mitigate a project's emissions;

(4) Measures that sequester greenhouse gases;

(5) In the case of the adoption of a plan, such as a general plan, long-range development plan, or plans for the reduction of greenhouse gas emissions, mitigation may include the identification of specific measures that may be implemented on a project-by-project basis. Mitigation may also include the incorporation of specific measures or policies found in an adopted ordinance or regulation that reduces the cumulative effect of emissions.

CEQA Guidelines § 15126.4(c). Also, organizations and public agencies have published lists of feasible and quantifiable greenhouse gas mitigation that should have been at least discussed in the Project DEIR, including the California Air Pollution Control Officers Association August 2010 report "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures" ("CAPCOA Report")[2] which the South Coast Air Quality Management District has recognized as a "comprehensive guidance document for quantifying the effectiveness of GHG mitigation measures."[3] O1-5 cont'd

The DEIR must analyze the effectiveness and feasibility of several greenhouse gas mitigation measures proposed by the CAPCOA Report, including greenhouse gas mitigation measures for building energy use, lighting, alternative energy generation, land use, landscaping, waste, vegetation, construction and different measures including carbon sequestration or other off-site mitigation measures.

2. The DEIR Fails to Adequately Analyze and Mitigate the Project's Significant Air Quality Impacts

The DEIR determines that air quality impacts resulting from construction activities after mitigation are "significant and unavoidable." DEIR at ES-6. However, the DEIR O1-6

[2] California Air Pollution Control Officers Association (August 2010) "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," accessed March 22, 2020, available at https://www.aqmd.gov/docs/default-source/ceqa/handbook/mitigation-measures-and-control-efficiencies/quantifying-greenhouse-gas-mitigation-measures.pdf?sfvrsn=0 (attached as Exhibit A)

[3] South Coast Air Quality Management District (2019) "Greenhouse Gases, accessed on March 22, 2019, available at https://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/greenhouse-gases (attached as Exhibit B)

again fails to discuss all feasible mitigation measures that could substantially lessen the Project's significant and unavoidable air quality impacts.

Mitigation measure AIR-1 provides that "prior to the issuance of a grading permit, the grading plans shall stipulate that the contractor shall use construction equipment that meets the U.S. Environmental Protection Agency (EPA) Tier 3 level of emission controls fitted with Level 2 Diesel Particular Filters (DPF) for all construction equipment 50 horsepower or more during construction activities." (DEIR, p. 1-20.)

The DEIR fails to discuss or explain why the latest technology, namely EPA Tier 4 construction equipment[4] with current Level 3 Diesel Particular Filters[5] would be infeasible. Tier 4 engines are required for all construction equipment constructed since 2014. 40 CFR § 1039.101 ("The exhaust emission standards for this section apply after the 2014 model year."). O1-6 cont'd

Mitigation measure AIR-2 provides that "the project contractor shall only use interior paints with low VOC content with a maximum concentration of 30 grams per liter (g/L) for residential building architectural coating to reduce VOC emissions."

Here too, the DEIR fails to explain why the Project does not utilize widely available Zero VOC paints with a maximum concentration of fewer than 5 grams per liter of VOCs[6].

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[4] United States Environmental Protection Agency Regulations for Emissions from Heavy Equipment with Compression-Ignition (Diesel) Engines, accessed March 22, 2020, available at https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-emissions-heavy-equipment-compression (attached as Exhibit C)

[5] California Air Resources Board "Verification Procedure" accessed March 22, 2020, available at https://ww3.arb.ca.gov/diesel/verdev/vt/cvt.htm (attached as Exhibit D)

[6] See e.g. California Department of Public Health (2018) "The Sherwin-Williams Company Commercial Painting Schedule Guide," accessed March 22, 2020, available at https://images.sherwin-williams.com/content_images/sw-099123_chps_2011.pdf (attached as Exhibit E); Sherwin-Williams "Green Programs Specifications" accessed March 22, 2020, available at https://www.sherwin-williams.com/home-builders/specifications/progs-and-voc-regs/leed-and-other-green-specifications (attached as Exhibit F); Greenguard "Your Guide to Low- and Zero-VOC Paints from Better Homes and Gardens magazine" accessed March 22, 2020, available at http://greenguard.org/files/LivingGreenPaintGuide.pdf (attached as Exhibit G).

D. The DEIR Omits Relevant Information Regarding the Existing Environment and Fails to Disclose Potential Contamination On the Project Site Adequately

The DEIR fails to disclose that the Project site is located in an area of prior agricultural use before 1975. The City conducted a Phase I Site Assessment (Appendix G) to identify evidence of "recognized environmental conditions," (REC) which includes "the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment." "De minimis conditions are not recognized environmental conditions." DEIR, Appx. G. P. 1.

Documents reviewed in the Site Assessment revealed that the Site had been used for agricultural purposes before 1975 and was occupied by Nissan Motor Corporation from approximately 1975 to 2011. *Id.* p. 12. A prior, unrelated Site Assessment reported potential environmental concerns related to "the historical agricultural use and potential presences of residual chemicals, historical industrial lighting operations during Nissan's occupancy, a former oil interceptor which was removed from the Site on November 17, 2010, and the potential for polychlorinated biphenyls (PCBs) to be present in onsite electrical transformers." *Id.* O1-7

The Phase I Site Assessment states, "the past agricultural use of the Site (dry farming) suggests that pesticides may have been used on the Site. If so, pesticides and associated metals may be present in soil on the Site." *Id.* p. 14-15. Despite this finding and well-known persistence of highly toxic pesticides employed in agricultural usage before 1975 in soil, the Site Assessment concludes, on insufficient evidence, that the historical agricultural usage is not considered a REC.

Only one soil sample was collected beneath the oil-interceptor upon its removal in 2010. *Id.* p. 12. No further soil assessment has been conducted to assess soil contamination due to the prior agricultural or industrial uses.

According to Appendix G of the CEQA Guidelines, a project would have a significant effect on the environment if the Project would (1) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials; or (2) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. The DEIR fails to adequately assess these potential impacts by failing to disclose and analyze possible soil contamination due to prior industrial and agricultural uses and the potential release of hazardous materials as a result of soil removal on the Site. O1-7 cont'd

II. CONCLUSION

Commenters request that the City revise and recirculate the Project's environmental impact report to address the concerns mentioned above. If the City has any questions or concerns, feel free to contact my Office. O1-8

Sincerely,

Mitchell M. Tsai
Attorneys for Southwest Regional Council of Carpenters

Attached:

California Air Pollution Control Officers Association (August 2010) "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," accessed March 22, 2020, available at https://www.aqmd.gov/docs/default-source/ceqa/handbook/mitigation-measures-and-control-efficiencies/quantifying-greenhouse-gas-mitigation-measures.pdf?sfvrsn=0 (attached as Exhibit A);

South Coast Air Quality Management District (2019) "Greenhouse Gases, accessed on March 22, 2019, available at https://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies/greenhouse-gases (attached as Exhibit B);

United States Environmental Protection Agency Regulations for Emissions from Heavy Equipment with Compression-Ignition (Diesel) Engines, accessed March 22, 2020, available at https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-emissions-heavy-equipment-compression (attached as Exhibit C);

California Air Resources Board "Verification Procedure" accessed March 22, 2020, available at https://ww3.arb.ca.gov/diesel/verdev/vt/cvt.htm (attached as Exhibit D);

California Department of Public Health (2018) "The Sherwin-Williams Company Commercial Painting Schedule Guide," accessed March 22, 2020, available at https://images.sherwin-williams.com/content_images/sw-099123_chps_2011.pdf (attached as Exhibit E);

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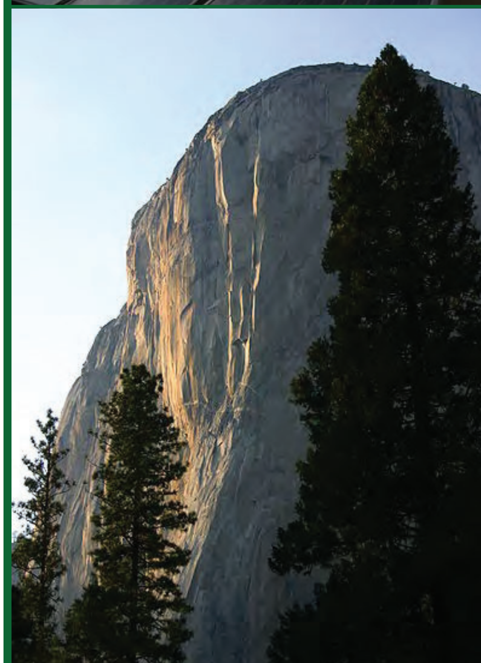
Greenguard "Your Guide to Low- and Zero- VOC Paints from Better Homes and Gardens magazine" accessed March 22, 2020, available at http://greenguard.org/files/LivingGreenPaintGuide.pdf (attached as Exhibit G).

EXHIBIT A

CAPCOA

CALIFORNIA AIR POLLUTION CONTROL OFFICERS ASSOCIATION



Quantifying
Greenhouse Gas Mitigation Measures

A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures

August, 2010

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California Air Pollution Control Officers Association

with

Northeast States for Coordinated Air Use Management

National Association of Clean Air Agencies

Environ

Fehr & Peers

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Disclaimer

The California Air Pollution Control Officers Association (CAPCOA) has prepared this report on quantifying greenhouse gas emissions from select mitigation strategies to provide a common platform of information and tools to support local governments.

This paper is intended as a resource, not a guidance document. It is not intended, and should not be interpreted, to dictate the manner in which a city or county chooses to address greenhouse gas emissions in the context of projects it reviews, or in the preparation of its General Plan.

This paper has been prepared at a time when California law and regulation, as well as accepted practice regarding how climate change should be addressed in government programs, is undergoing change. There is pending litigation that may have bearing on these decisions, as well as active legislation at the federal level. In the face of this uncertainty, local governments are working to understand the new expectations, and how best to meet them. This paper is provided as a resource to local policy and decision makers to enable them to make the best decisions they can during this period of uncertainty.

Finally, in order to provide context for the quantification methodologies it describes, this report reviews requirements, discusses policy options, and highlights methods, tools, and resources available; these reviews and discussions are not intended to provide legal advice and should not be construed as such. Questions of legal interpretation, or requests for legal advice, should be directed to the jurisdiction's counsel.

Table of Contents

Executive Summary

This report on *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures* was prepared by the California Air Pollution Control Officers Association with the Northeast States for Coordinated Air Use Management and the National Association of Clean Air Agencies, and with technical support from Environ and Fehr & Peers. It is primarily focused on the quantification of project-level mitigation of greenhouse gas emissions associated with land use, transportation, energy use, and other related project areas. The mitigation measures quantified in the Report generally correspond to measures previously discussed in CAPCOA's earlier reports: *CEQA and Climate Change*; and *Model Policies for Greenhouse Gases in General Plans*. The Report does not provide policy guidance or advocate any policy position related to greenhouse gas emission reduction.

The Report provides a discussion of background information on programs and other circumstances in which quantification of greenhouse gas emissions is important. This includes voluntary emission reduction efforts, project-level emission reduction efforts, reductions for regulatory compliance, and reductions for some form of credit. The information provided covers basic terms and concepts and again, does not endorse or provide guidance on any policy position.

Certain key concepts for quantification are covered in greater depth. These include baseline, business-as-usual, types of emission reductions, project scope, lifecycle analysis, accuracy and reliability, additionality, and verification.

In order to provide transparency and to enhance the understanding of underlying strengths and weaknesses, the Report includes a detailed explanation of the approaches and methods used in developing the quantification of the mitigation measures. There is a summary of baseline methods (which are discussed in greater detail in Appendix B) as well as a discussion of methods for the measures. This includes the selection process for the measures, the development of the quantification approaches, and limitations in the data used to derive the quantification.

The mitigation measures were broken into categories, and an overview is provided for each category. The overview discusses specific considerations in quantifying emissions for measures in the category, as well as project-specific data the user will need to provide. Where appropriate and where data are readily available, the user is directed to relevant data sources. In addition, some tables and other information are included in the appendices.

The mitigation measures are presented in Fact Sheets. An overview of the Fact Sheets is provided which outlines their organization and describes the layout of information. The Report also includes a step-by-step guide to using a Fact Sheet to quantify a project, and discusses the use of Fact Sheets outside of California. The Report also discusses the grouping of the measures, and outlines procedures and limitations for quantifying projects where measures are combined either within or across categories. These limitations are critical to ensure that emission reductions are appropriately quantified and are not double counted. As a general guide, approximate ranges of effectiveness are provided for each of the measures, and this is presented in tables at the end of Chapter 6. These ranges are for reference only and should not be used in lieu of the actual Fact Sheets; they do not provide accurate quantification on a project-specific basis.

The Fact Sheets themselves are presented in Chapter 7, which includes an index of the Fact Sheets and cross references each measure to measures described in CAPCOA's earlier reports: *CEQA and Climate Change*; and *Model Policies for Greenhouse Gases in General Plans*. Each Fact Sheet includes a description of the measure, assumptions and limitations in the quantification, a baseline methodology, and the quantification of the measure itself. There is also a sample project calculation, and a discussion of the data and studies used in the development of the quantification.

In the Appendices, there is a glossary of terms. The baseline methodology is fully explained, and there is additional supporting information for the transportation methods and the non-transportation methods. Finally, the Report includes select reference tables that the user may consult for select project-specific factors that are called for in some of the Fact Sheets.

Chapter 1: Introduction

Background

The California Air Pollution Control Officers Association (CAPCOA) prepared the report, *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures* (Quantification Report, or Report), in collaboration with the Northeast States for Coordinated Air Use Management (NESCAUM) and the National Association of Clean Air Agencies (NACAA), and with contract support from Environ, and Fehr & Peers, who performed the technical analysis. The Report provides methods for quantifying emission reductions from a specified list of mitigation measures, primarily focused on project-level mitigation. The emissions calculations include greenhouse gases (GHGs), particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO2), and reactive organic gases (ROG), as well as toxic air pollutants, where information is available.

The measures included in this Report were selected because they are frequently considered as mitigation for GHG impacts, and standardized methods for quantifying emissions from these projects were not previously available. Measures were screened on the basis of the feasibility of quantifying the emissions, the availability of robust and meaningful data upon which to base the quantification, and whether the measures (alone or in combination with other measures) would result in appreciable reductions in GHG emissions. CAPCOA does not mean to suggest that other measures should not be considered, or that they might not be effective or quantifiable; on the contrary, there are many options and approaches to mitigate emissions of GHGs. CAPCOA sought to provide a high quality quantification tool to local governments with the broadest applicability possible, given the resource limitations for the project. CAPCOA encourages local governments to be bold and creative as they approach the challenge of climate change, and does not intend this Report to limit the scope of measures considered for mitigation.

The majority of the measures in the Report have been discussed in CAPCOA's previous resource documents: *CEQA and Climate Change*, and *Model Policies for Greenhouse Gases in General Plans*. The measures in this Report are cross-referenced to those prior reports. The quantification methods provided here are largely project-level in nature; they can certainly inform planning decisions, however a complete planning-level analysis of mitigation strategies will entail additional quantification.

In developing the quantification methods, CAPCOA and its contractors conducted an extensive literature review. The goal of the Report was to provide accurate and reliable quantification methods that can be used throughout California and adapted for use outside of the state as well.

Intent and Audience

This document is intended to further support the efforts of local governments to address the impacts of GHG emissions in their environmental review of projects and in their planning efforts. Project proponents and others interested in quantifying mitigation measures will also find the document useful.

The guidance provided in this Report specifically addresses appropriate procedures for applying quantification methods to achieve accurate and reliable results. The Report includes background information on programs and concepts associated with the quantification of GHG emissions. The Report does not provide policy guidance on any of these issues, nor does it dictate how any jurisdiction should address questions of policy. Policy considerations are left to individual agencies and their governing boards. Rather, this Report is intended to support the creation of a standardized approach to quantifying mitigation measures, to allow emission reductions and measure effectiveness to be considered and compared on a common basis.

Because the quantification methods in this Report were developed to meet the highest standards for accuracy and reliability, CAPCOA believes they will be generally accepted for most quantification purposes. The decision to accept any quantification method rests with the reviewing agency, however. Further, while the Report discusses the quantification of GHG emissions for a variety of purposes, including the quantification of reductions for credit, using these methods does not guarantee that credit will be awarded.

Using the Document

Chapters 2 and 3 of this Report discuss programs and concepts associated with GHG quantification. They are intended to provide background information for those interested in the context in which reductions are being made. Chapter 4 discusses the underpinnings of the quantification methods and specifically addresses limitations in the data used as well as limitations in applying the methods; it is important for anyone using this Report to review Chapter 4. Chapter 5 provides an overview of the mitigation measure categories, including key considerations in the quantification of emission reductions in those categories. Chapter 6 explains how to use the fact sheets for each measure's quantification method, and also discusses the effectiveness of the measures and how combining measures changes the effectiveness.

Once the user understands the quantification context, and the limitations of the methods, the fact sheets can be used like recipes in a cookbook . In using the fact sheets, however, CAPCOA strongly advises the reader to pay careful attention to the assumptions and limitations set forth for each individual measure, and to make sure that these are respected and appropriately considered.

The fact sheets with the actual quantification methods for each individual measure are contained in Chapter 7. The baseline methods are explained in Appendix B. It is the responsibility of the user to ensure that all data inputs are provided as called for in the methods, and that the data are of appropriate quality.

CAPCOA will not be able to provide case-by-case review or adjustments for specific projects outside of the provision for project-specific data inputs that is part of each fact sheet. Questions about individual projects may be referred to your local air district.

As a final note, the methods contained in this document include generalized information about the measures themselves. This information includes emission factors, usage rates, and other data from various sources, most commonly published data from public agencies. The data were carefully reviewed to ensure they represent the best information available for this purpose. The use of generalized information allows the quantification methods to be used across a range of circumstances, including variations in geographical location, climate, and population density, among others.

Where good quality, project-specific data is available that provides a superior characterization of a particular project, it should be used instead of the more generalized data presented here. The methods provided for baseline and mitigated emissions scenarios allow for such substitution. The local agency reviewing the project should review the project-specific data, however, to ensure that it meets standards for data quality and will not result in an inappropriate under- or overestimation of project emissions or mitigation.

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Quantification Framework

The Quantification Report has been prepared to support a range of quantification needs. It is based on the premise that quantification of GHG emissions and reductions should rest on a foundation of clear assumptions, limits, and calculations. When these elements and the methods of applying them are transparent, a common "language" is created that allows us to talk about, compare, and evaluate GHGs with confidence that we are looking at "apples to apples."

For the purpose of this report, GHGs are the six gases identified in the Kyoto Protocol: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). GHGs are expressed in metric tons (MT) of CO_2e (carbon dioxide equivalents). Individual GHGs are converted to CO_2e by multiplying values by their global warming potential (GWP). Global warming potentials represent a ratio of a gas' heat trapping characteristics compared to CO_2, which has a global warming potential of 1.

As a general rule, the quantification methods in this report are only accurate to the degree that the project adheres to the assumptions, limitations, and other criteria specified for a given measure. Where specific data inputs are indicated for either the baseline or the project scenario calculations, those data must be provided for the calculations to be valid. Further, the quality of the data used will substantially impact the quality of the results achieved. For example, if a calculation method calls for a traffic count, the calculations can't be made without supplying a traffic count number. However, the number used could be a rough estimate, could be based on a small, one-time sample, or could be derived through a full traffic study over a representative period of time or times. Clearly, using a rough estimate for any of the data inputs will yield results that are less accurate than they would be if higher quality data inputs were provided.

This does not mean that rough estimates cannot be used. There will be times when the quantification does not need to be precise. In order to speak the common language, however, it is important to identify how precise your data inputs are. It is also important to give careful consideration to the intended use of the quantification, to make sure that the results you achieve will be sufficiently rigorous to support the conclusions you draw from them.

The quantification methods in this report rely on very specific assumptions and limitations for each mitigation measure. Unlike the discussion of data inputs, the measure assumptions and limits affect more than the precision of the calculations: they determine whether the calculation is valid at all. For example, there is a method for calculating GHG reductions for each percentage in improvement in building energy use beyond the performance standards in California's Title 24; that method states that the measure is specifically for electricity and natural gas use in residential and commercial buildings subject to Title 24. If the building is located outside of California, where Title 24 is not applicable, the method will not yield accurate results unless the baseline assumptions are adjusted to reflect the standards that actually apply. Further, the measure effectiveness is based on assumptions that certain other energy efficiency measures are also applied (such as third-party HVAC-commissioning); if those additional measures are not applied, the calculated reductions will not be accurate and will overestimate the reductions compared to what will actually be achieved.

There may be situations where you choose to apply a method even if the assumptions do not match the specific conditions of the project; while CAPCOA does not recommend this, if you do it, it is imperative that any deviations are clearly identified. While you may still be able to calculate a reduction for your measure, in many cases the error in your result will be so large that any conclusions you would draw from the analysis could be completely wrong.

Quantifying Measures for Different Purposes

There are several reasons that a person might implement measures to reduce GHG emissions. Some measures are implemented simply because it's a good thing to do. Knowing how many metric tons of GHG emissions were reduced might not be important in that case. There are other reasons for undertaking a project to reduce GHGs, however, and for some of these purposes quantification (and verification) become increasingly important, and sensitive. This chapter discusses the role of quantification, and to a lesser extent verification, in reductions undertaken for a range of reasons. These include: voluntary reductions, reductions undertaken specifically to mitigate current or future impacts, reductions for regulatory compliance, and reductions where some form of credit is being sought, including credits that may be traded on a credit exchange. The purpose for which reductions are quantified will determine the level of detail involved in the quantification, as well as the degree of verification needed to support the quantification. As stated previously, this discussion is provided for information purposes only; it should not be construed to advocate or endorse any particular policy position.

Voluntary Reductions

Voluntary reductions of GHG emissions are reductions that are not required for any reason, including a regulation, law, or other form of standard. Even when reductions are not mandatory, however, there may be reasons to quantify them. The project proponent may simply want to know how effective the project is. Examples of this would be when a project is undertaken in an educational setting, or to demonstrate the general feasibility of a concept, or promote an image of environmental responsibility. In such a case, the focus may be on implementing the project more than documenting exactly how many tons of CO_2e have been reduced, and a reasonable estimate might be sufficient. The project proponent may wish to track reductions to fulfill an organizational policy or commitment, or to establish a track record in GHG reductions. For these purposes, the quantification does not need to be precise, but it should still be based on sound principles and accepted methods.

When reductions are purely voluntary, they may be estimated using the methods contained in this document, even if all of the variables are not known, or if some of the assumptions are not fully supported by the specifics of the project. If the quantification is performed without the level of detail outlined in the method for a given measure (or specified for the baseline calculations), the results will be less accurate. The same is true if a method is used in a situation where the assumptions are not fully supported, or if the method is used outside the noted limitations. As one would expect, the greater the degree of variation from the conditions put forth in the fact sheets, the less accurate the quantification will be. Significant deviation can result in very large errors.

If there is any possibility that the project proponent may at some point wish to use the reductions to fulfill a future regulatory or mitigation requirement, or seek some form of credit for the reductions, the proponent should not deviate from the methods and should ensure that all necessary data are included, and all assumptions and limitations are appropriately addressed. Acceptance of the quantification methods in this Report to fulfill any requirement is solely at the discretion of the approving agency. Use of these methods does not guarantee that credit of any kind will be awarded for reductions made.

Reductions to Mitigate Current or Future Impacts

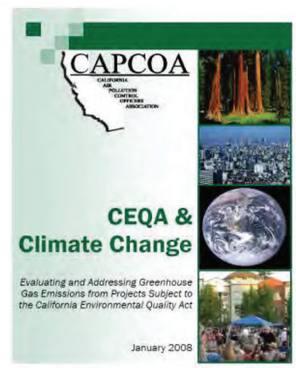
One of the most common reasons for quantifying emissions of GHG is to analyze and mitigate current or future impacts of specific actions or activities. This can include project-level impacts, such as those evaluated under the California Environmental Quality Act (CEQA), or plan-level impacts, such those resulting from the implementation of a General Plan or Climate Action Plan. Quantification of projects and mitigation under CEQA was the main focus in preparing this guidance document. Most of the measures quantified in the Report are project-level in nature. Many of these are also good examples of the kinds of policies and actions that would be included in a General Plan or a Climate Action Plan. The quantification methods provided here can be used to support conclusions about the effectiveness of different measures in a planning context; however, a full analysis of plan-level impacts will require consideration of additional factors, depending on the nature of the measure. Some of the measures have been specifically identified as General Plan measures, and a discussion is included about appropriate analysis of these measures, where study data exist to support such analysis.

Project-Level Mitigation: Existing environmental law and policy requires that environmental impacts of projects be evaluated and disclosed to the public, and where those impacts are potentially significant, that they be mitigated. At the federal level, the National Environmental Protection Act (NEPA) governs this evaluation. Many states have their own programs as well; in California, the California Environmental Quality Act, or CEQA, sets forth the requirements and the framework for the review.

The responsibility to evaluate impacts, to determine significance, and to define appropriate mitigation rests with the Lead Agency. This is typically a city or county with land-use decision-making authority, although other agencies can be Lead Agencies, depending on the nature of the project and the jurisdiction of the agency.

Guidance on CEQA and Climate Change: There are currently two resources for Lead Agencies on incorporating considerations of climate change into their CEQA processes. The first was prepared by CAPCOA, and the most recent is an amendment to the official CEQA Guidelines prepared by the California Natural Resources Agency (Resources Agency).

CAPCOA Guidance- In January of 2008, CAPCOA released a resource document, *"CEQA and Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act,"* that discussed different approaches to determining whether GHG emissions from projects are significant under CEQA. It reviewed the models and other tools available at that time for conducting GHG analyses, and the document also contained a list of mitigation measures. A copy of the report is available at *http://www.capcoa.org*.



Resources Agency Guidance- Since the release of that report, the California Natural Resources Agency (Resources Agency) finalized its guidance on GHG emissions and CEQA in December of 2009. Under Senate Bill 97 (Chapter 148, Statutes of 2007), the Governor's Office of Planning and Research (OPR) was required to prepare amendments to the state's CEQA Guidelines addressing analysis and mitigation of the potential effects of GHG emissions in CEQA documents. The legislation required the Resources Agency to adopt the amended Guidelines by 2010.

The CEQA Guidelines Amendments adopted by the Resources Agency made material changes to 14 sections of the Guidelines. The changes include dealing with the determination of significance (principally in Public Resource Code Section 15064) and cumulative impacts, as well as areas such as the consultation process for the draft EIR, the statement of overriding considerations, the environmental setting, mitigation measures, and tiering and streamlining. Overall, the discussion of determining significance in

these amendments is consistent with the earlier report released by CAPCOA.

In the Final Statement of Reasons (SOR) for the adoption of the amendments to the CEQA Guidelines, the Resources Agency makes two points that are important with regard to quantification of GHG emissions from projects. First, it states that the Guidelines "appropriately focus on a project's potential incremental contribution of GHGs" and that the amendments "expressly incorporate the fair argument standard." [1] This sets the parameters for the analysis to be performed. The Resources Agency further states that the analysis for GHGs must be consistent with existing CEQA principles, which includes standards for the substantial evidence needed to support findings.

Second, the Final SOR specifically states that the amendments "interpret and make specific statutory CEQA provisions and case law … determining the significance of GHG emissions that may result from proposed projects."[2] In this context, they cite specific case law as well as CEQA Guidelines Section 15144 that require a lead agency to "meaningfully attempt to quantify the Project's potential impacts on GHG emissions and determine their significance."[3]

Complete copies of the 2009 CEQA Guidelines Amendments and the Final Statement of Reasons may be downloaded at: *http://ceres.ca.gov/ceqa/docs/*.

<u>Quantification of Projects</u>: Project level quantification, especially as it pertains to CEQA, was CAPCOA's main focus in developing this Report. The baseline conditions and quantification methods were selected to be consistent with the implementation of AB 32, as well as the Scoping Plan developed by ARB. The list of mitigation measures selected for the Report reflects the types of strategies that local governments and project proponents have shown interest in, and sought direction on quantifying. For the most part, they entail clearly delineated boundary conditions, and have been designed to be applicable across a range of circumstances.

This Quantification Report does not provide any policy guidance on what amount of GHG emissions would be significant. The determination of significance, including any thresholds, is the exclusive purview of the Lead Agency and its policy board. CAPCOA's Quantification Report provides methods to quantify emissions from specific types of mitigation projects or measures. It is based on a careful review of existing studies and determinations to develop rigorous quantification methods that meet the substantial evidence requirements of CEQA.

A project proponent or reviewer who wishes to use these methods to quantify emissions for the purpose of complying with CEQA must adhere to the assumptions and limitations

[1] California Natural Resources Agency: "Final Statement of Reasons for Regulatory Action: Amendments to the State CEQA Guidelines Addressing and Analysis and Mitigation of Greenhouse Gas Emissions Pursuant to SB 97," December, 2009; p 12.
[2] Ibid: p. 18.
[3] Ibid: p. 18.

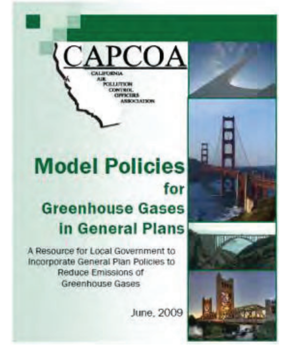
specified in the methods for each project type. If these assumptions and limitations are not followed, the quantification will not be valid. Ultimately, the Lead Agency will have the responsibility to review and decide whether to allow any requests for deviations from the method, and to determine whether those deviations have a substantive impact on the results. Lead Agencies may contact their local air district for assistance in making such a review, but CAPCOA will not be in a position to provide any case-by-case review of changes to the quantification methods in this report.

As stated previously, where good quality, project-specific data are available, they should be substituted for the more generalized data used in the baseline and mitigation emissions calculations. The quality of the data inputs can significantly affect the accuracy and reliability of the results. When quantification is performed for CEQA compliance, CAPCOA recommends that project-specific data be as robust as possible. We discourage the use of approximations or unsubstantiated numbers. In any case, CAPCOA strongly recommends that the source(s) and/or basis of all project-specific data supplied by the project proponent be clearly identified in the analysis, and the limitations of the data be discussed.

Plan-Level Mitigation: Cities and counties, as well as other entities, develop environmental planning documents. The most common are General Plans, which specify the blueprint for land-use, transportation, housing, growth, and resource management for cities, counties, and regions. These plans are periodically updated, and in recent updates, the California Attorney General has put jurisdictions on notice that their plans must consider climate change.

A stand-alone plan that considers climate change is a Climate Action Plan. Climate Action Plans can be developed for a school or company, for a city, county, region, or larger jurisdiction. A Climate Action Plan will typically identify a reduction target or commitment, and then set forth the complement of goals, policies, measures, and ordinances that will achieve the target. These policies and other strategies will typically include measures in transportation, land use, energy conservation, water conservation, and other elements.

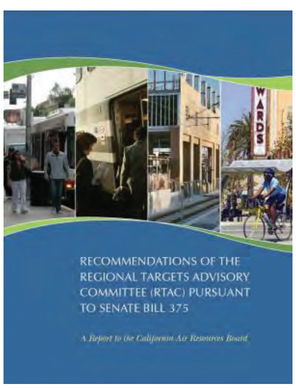
Guidance on Planning and Climate Change: CAPCOA prepared a guidance document on GHGs and General Plans for local governments. There are also several important processes under way that will have a significant impact on the planning process in the coming years. These include the early implementation of Senate Bill 375 (Steinberg, Statutes of 2008); the development of new General Plan Guidelines; and statewide planning for adaptation to the impacts of climate change. They are described below.



CAPCOA Guidance for General Plans- In June of 2009, CAPCOA released "*Model Policies for Greenhouse Gases in General Plans: A Resource for Local Government to Incorporate General Plan Policies to Reduce Emissions of Greenhouse Gases*." This document embodied a menu of GHG mitigation measures that could be included in a General Plan or a Climate Action Plan. It was structured around the elements of a General Plan, provided model language that could be taken and dropped into a plan, and also provided a worksheet for evaluating which measures to use. The CAPCOA Model Policies document focused on strategies to reduce GHG emissions; it did not address climate change adaptation, which is an important, but separate consideration.

<u>*Senate Bill 375*</u>- Senate Bill 375 is considered a landmark piece of legislation that aligns regional land use, transportation, housing, and greenhouse gas reduction planning efforts. The bill requires the ARB to set greenhouse gas emission reduction targets for light trucks and passenger vehicles for 2020 and 2035. The 18 Metropolitan Planning Organizations (MPOs) are responsible for preparing Sustainable Communities Strategies and, if needed, Alternative Planning Strategies (APS), that will include a region's respective strategy for meeting the established targets. An APS is an alternative strategy that must show how the region would, if implemented, meet the target if the SCS does not.

To develop the targets, SB 375 called for a Regional Targets Advisory Committee (RTAC), which included representatives from the MPOs, cities and counties, air districts, elected officials, the business community, nongovernmental organizations, and experts in land use and transportation. The RTAC provided recommendations on the targets to ARB in a formal report in September, 2009. The report covers a range of important considerations in target setting and implementation. Target setting topics include: the use of empirical data and modeling; key underlying assumptions; best management practices; the base year, the metric, targets for 2020 and 2035; and both statewide and regional factors affecting transportation patterns. For implementation, the report considers housing and social equity issues; local government challenges in meeting the targets; funding and other support at the state and federal level; and a variety of other important considerations. A complete copy of the report may be downloaded at: *http://www.arb.ca.gov/cc/sb375/rtac/report/092909/finalreport.pdf*.



ARB staff released draft regional targets for 2020 for the four largest MPOs in June, 2010, along with placeholder targets for 2035. Placeholder targets were also issued for both 2020 and 2035 for MPOs in the San Joaquin Valley. An alternative approach to target setting was proposed for the remaining MPOs. As required by SB 375, ARB expects to formally adopt the final targets before the end of September, 2010. Additional information about the target setting process can be found at: *http://www.arb.ca.gov/cc/sb375/sb375.htm*.

For the four largest MPOs, the draft 2020 targets are expressed as a percent reduction in emissions based on the potential reductions from land use and transportation planning scenarios provided by the MPOs, with a proposed range for the targets between 5% and 10%[4]. This reduction excludes the expected emission reductions from Pavley GHG vehicle standards and low carbon fuel standard measures. Each of the four regions has its own placeholder targets for 2035, shown in Table 2-1, below.

Table 2-1: Draft Regional Targets for 2035

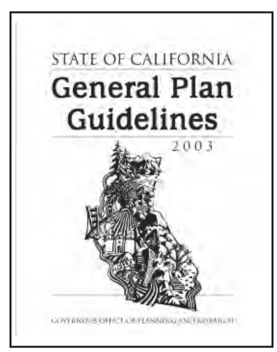
Regional MPO	Draft GHG Reduction Target
Metropolitan Planning Commission (MTC)	3-12%
Sacramento Area Council of Governments (SACOG)	13-17%
San Diego Association of Governments (SANDAG)	5-19%
Southern California Association of Governments (SCAG)	3-12%

Source: ARB: "Draft Regional Greenhouse Gas Emission Reduction Targets For Automobiles and Light Trucks Pursuant to Senate Bill 375" page 4.

The placeholder targets for the MPOs in the San Joaquin Valley range from 1-7% for both 2020 and 2035. Placeholder targets were provided in lieu of draft targets to allow the MPOs to provide additional information for ARB to consider before finalizing the targets. For the remaining six MPOs, ARB proposes to use the most current per-capita GHG emissions data, adjusted for the impacts of the recession, as the basis for setting individual regional targets in those areas.

In addition to serving on the RTAC, local districts will support the MPOs as they develop their strategies to meet their regional targets, and local cities and counties as they incorporate sustainable strategies into their own planning efforts. Two of the contractors who developed the quantification methods in this Quantification Report also served on the RTAC, and every effort has been made to ensure that work here will ultimately be compatible with, and useful in, the implementation of SB 375.

General Plan Guidelines- The Governor's Office of Planning and Research (OPR) provides technical assistance on land use planning and CEQA matters to local governments. In this effort, OPR is required to adopt and periodically revise advisory guidelines to assist local governments in the preparation of local general plans. Commonly referred to as the General Plan Guidelines, the most current edition was released in 2003.



In the 2003 edition, OPR included an overview of the General Plan statutory requirements, a review of CEQA's role in the general plan process, implementation techniques, and the General Plan's relationship to other statutory planning requirements. The 2003 Guidelines do not specifically address GHG emissions or climate change.

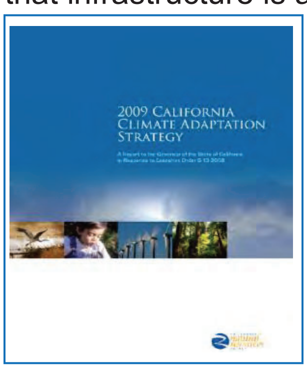
[4] ARB: "Draft Regional Greenhouse Gas Emission Reduction Targets For Automobiles and Light Trucks Pursuant to Senate Bill 375," June, 2010; page 4.

It is important to note that the General Plan Guidelines are advisory, not mandatory. Nevertheless, it is the state's only official document explaining California's legal requirements for general plans. The General Plan Guidelines are continually shaped to reflect current trends, changes in applicable laws, and incorporate additional statutory requirements. This includes anticipated effects from AB 32 and SB 375.

An update to the 2003 General Plan Guidelines has been in development and includes a Climate Change Supplement. This update is expected to be finalized by the end of 2010.

Adaptation- Adaptation has not received the same attention that has been given to steps that might prevent or mitigate the extent of climate change, however it is a topic that should not be ignored in General Plans. The overwhelming body of scientific studies point to a certain amount of change in our climate that is inevitable, even if we are aggressive and diligent in our efforts to prevent it. Many regions of the state (indeed, the nation) are projected to see substantial impacts on agriculture, climate dependant business (such as recreation and tourism), infrastructure, and habitat. Coastal areas will see a rise in sea level, currently projected to be between one and three meters by 2100. Wild fires are expected to increase in number, size, and severity. Stresses on the environment, combined with extreme weather events, are projected to increase the incidence and severity of a number of infectious diseases and other medical conditions. These and myriad other changes pose tremendous risks to people and our way of life.

For that reason, in December, 2009, a team of California state agencies released a report: "The 2009 Climate Adaptation Strategy." In it, the team states that 2.5 trillion dollars' worth of infrastructure in California is at risk from the various projected climate-related changes in our environment. The estimated cost of addressing the impacts on that infrastructure is about $3.9 billion, annually.[5] The report identifies a number of



steps to be taken in the near term to appropriately plan for and address this threat. Highlights of the actions include: the formation of a Climate Adaptation Advisory Panel; new approaches to water management; revised land-use planning to avoid construction in highly vulnerable areas; evaluation of all state infrastructure projects to avoid exacerbating threats to infrastructure; and, more specific planning by emergency response agencies, public health agencies, and others to fortify existing communities and resources, and prepare for future stressors. For more information, the full report may be downloaded at: *http://www.energy.ca.gov/2009publications/CNRA-1000-2009-027/CNRA-1000-2009-027-F.PDF*.

Quantification for Planning Purposes: Quantification of the impacts of measures for planning purposes is a different exercise than quantification for a specific project. By its

[5] California Natural Resources Agency: "2009 Climate Adaptation Strategy" Dec. 2009; p. 5.

very nature, planning involves a future set of conditions about which less is known, and indeed knowable. The art and science of planning depend upon the interpretation of present conditions and trends, and the application of that interpretation to create a picture of future conditions. This document does not address detailed planning analysis in a comprehensive manner.

The majority of the measures described and quantified here are project-level measures; only a few are plan-level measures by design. That said, many of the project level measures are good examples of the implementation of planning-level policies that were described in the CAPCOA Model Policies report. The quantification of these measures will provide important and useful information for the planner to use in the context of quantifying anticipated effects in broader planning efforts.

In a planning context, it is especially important to be mindful of the interactions of different measures. A more detailed explanation is provided in Chapter 6, but the main concern is that certain measures do interact with each other, and their effects are not independent. This means that some measures will have little effect on their own, but in combination with other measures may have significant effect. The classic example of this is the bus shelter. A clean, well-lit, and comfortable bus shelter can enhance ridership on the buses stopping at that shelter and therefore reduce vehicle trips; but without the underlying bus service, the shelter itself does not reduce vehicle trips.

There are also instances where a measure is less effective in combination with other measures than it might be by itself. There are several reasons why this can occur. In some cases this happens because of a diminishing return for consecutive efforts. For example, there may be six good methods to increase ridership on a public transit line, any one of which might increase transit ridership by 20%. But implementing all of them will not necessarily increase ridership by 120%. In fact, for each successive method applied, it is likely that a lesser effect will be observed. Another example is where the measures are in some sense competing, as in a campaign to increase ridership on a commuter rail line at the same time that a new public transit bus line is established with overlapping service areas. Although the ridership campaign might be expected to cause 5% of drivers to switch to rail, some of those potential new riders might use the new bus service instead, making the ridership campaign less effective. At the same time, the new bus line might also be expected to reduce vehicle trips by 5%, but the actual reduction may be lower in reality if some of the ridership comes from those who would have been rail passengers and not from driving. Together, the ridership campaign for the rail line and the new bus line may only reduce vehicle trips by 7%, not the 10% predicted from the estimates of their independent effectiveness.[6]

These effects become more pronounced when considered in a city-wide, county-wide, or regional context. The interplay of land use decisions and transportation infrastructure development will be better assessed with more integrated computer modeling efforts. The quantification of some of the strategies at the individual, project level will provide

[6] Please note that the effectiveness estimates provided here are only for the purposes of illustration and should not be taken as actual quantification of such measures.

insight into how useful and appropriate the strategies will be in the planning effort, however. More detailed discussion of how to quantify combinations of measures is provided in Chapter 6.

Reductions for Regulatory Compliance

There are three basic types of regulations for which emissions quantification is likely to be required: command-and-control regulations, permitting, and participation in a cap-and-trade program. A discussion of each is provided for information purposes, as is a discussion of quantification for mandatory emissions reporting regulations. The quantification methods in this document are intended primarily for use in project-level mitigation. Regulatory programs are likely to have specific requirements for monitoring, reporting, and quantification, which may or may not allow the use of the methods in this Report.

Command and Control Regulations: Some local air districts have command-and-control regulations for GHGs already on the books. These include limitations on the use of certain chemicals that are active in the atmosphere, performance requirements for landfill gas collection, and for systems that use GHGs with high Global Warming Potential, as well as efficiency standards for specific equipment or processes. Under the umbrella of the Scoping Plan, the ARB is also developing command-and-control regulations for a number of source categories. Regulations already adopted include standards for various GHGs that have a high global warming potential, such as sulfur hexafluoride (SF_6) used in the electricity sector, semiconductors, and other operations; perfluorocarbons in semiconductor manufacturing; certain refrigerants; and materials used in consumer products. There are also GHG emission limits on light-duty vehicles, rules for port drayage trucks and other heavy-duty vehicles, as well as landfill methane control requirements, and the Low Carbon Fuel Standard. Additional rulemaking is currently underway.

For these types of regulations, compliance may not rest upon quantification of emissions or emissions reductions. In many cases, installation of a specific technology, substitution of materials, or implementation of inspection and maintenance programs meets the requirements of the rule, and is presumed to have a certain effectiveness in reducing emissions from a baseline level. When a focused regulation does require quantification of emissions, it will generally specify a method for testing emissions, where appropriate, or for calculating emissions from other measured parameters.

A related, but more flexible type of regulation for emission reductions is an overall emissions cap for facilities or operations. Under this approach, sometimes referred to as a “bubble,” the regulation calls for an overall reduction in emissions from a specified baseline, but the operator has the discretion to decide how to achieve those reductions. This is different from a cap-and-trade program (see below), in that there is no trading between facilities, or purchasing of credits to offset obligations. Because energy efficiency and other conservation projects are a likely strategy to meet a facility-wide GHG emission reduction requirement, the quantification of measures in this Report may be useful for compliance with such a cap. Of course, the caveats about assumptions and data inputs are also important here. Further, demonstration of compliance with this kind of limit will also involve verification of the emissions reductions, and is likely to include ongoing compliance tracking.

The regional targets of SB 375 are a type of emissions cap. It is important to note that the quantification presented in this Report may ultimately be useful in demonstrating reductions towards those targets. Although much of the work of implementing SB 375 will involve extensive land use and transportation modeling, the project level quantification in this Report may allow cities and counties to track their contribution towards their region's goal.

Permitting Programs: In addition to land-use permitting (discussed under "Project-level Mitigation" above), there may be requirements for operations to have permits to emit GHGs because GHGs are air pollutants. Federal air permitting requirements for stationary sources will become effective on January 1, 2011 (and will apply to applications that have not been acted upon prior to that date), under several federal permit programs, including Prevention of Significant Deterioration (PSD) and Title V. These programs are implemented by the local air districts. Applicability of these programs is based on annual potential to emit GHGs, with thresholds initially set between 75,000 and 100,000 tons per year, depending on the program, and decreasing over time, with final thresholds for smaller sources of GHG to be determined by a future federal rulemaking.

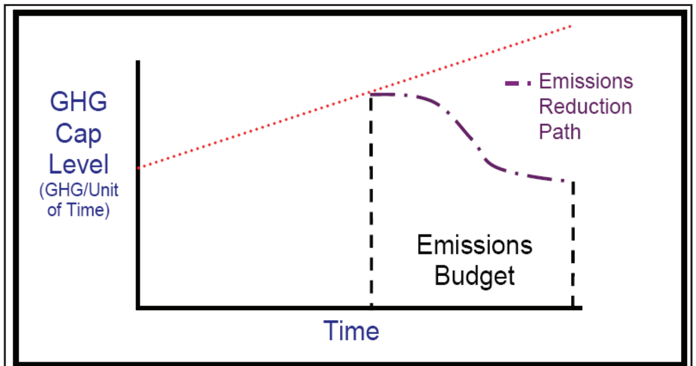
Because these permit programs are threshold-driven, quantification of emissions is an important element of compliance. At present, there is no specific federal guidance on quantifying GHG emissions pursuant to these programs, other than general guidelines for quantifying emissions of other regulated pollutants. This Quantification Report does not specifically address stationary source emissions, however some of the methods may be useful for certain elements of these programs, such as energy efficiency, water efficiency, and other associated measures of carbon use by a facility. The local air district with jurisdiction will be able to provide guidance on calculating emissions for a specific project, both for applicability and for compliance.

In addition, most permits require some form of verification, and ongoing demonstration on compliance. These obligations will be established as part of the permit.

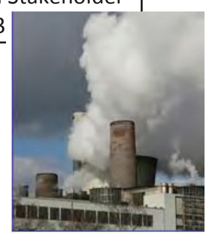
Cap-and-Trade: A cap-and-trade program is a specific type of emissions trading program. Emissions trading in general is discussed in the next section. A brief explanation of cap-and-trade programs is provided below as background information for interested readers. It is not necessary to understand cap and trade programs, or emissions trading in general, in order to use the quantification methods in this report.

Further, these quantification methods were not developed specifically for the purposes of complying with cap and trade requirements, or for emissions trading more generally.

A cap-and-trade regulation establishes “allowances” for carbon emissions, expressed as CO_2 equivalents, usually in tons, or metric tons. An emitter of carbon must hold enough allowances to cover the amount of carbon it actually emits. Allowances are obtained on a carbon exchange, or market. In some cases they may be allocated by the government to emitters. There is a “cap” placed on the amount of allowances available in the market, and the cap declines over time. Carbon emitters must either reduce their emissions or purchase allowances from someone else; this is the “trade” part of the program. In this way, the program should cause carbon to be reduced wherever the reduction costs are lowest. The ARB is developing a cap-and-trade program which they currently expect will be considered for Board approval before the end of 2010. Information about the developing ARB program can be obtained from the conceptual drafts released by staff. Legislation is also pending at the federal level that would establish cap-and-trade on a national scale, but the ultimate scope and content of the program is still unknown. The most recent ARB draft proposal may be downloaded at: *http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm*.



From ARB materials for AB 32 Program Design Technical Stakeholder Working Group Meeting, April 25, 2008, Figure 1, page 3



Although compliance with a cap-and-trade program is not likely to be a reason for quantifying GHG reductions today, it is likely to be one in the future. When that time comes, there will be several important considerations in deciding whether to use this Quantification Report in meeting those obligations.

Mandatory Reporting: The ARB currently has a Mandatory Reporting Rule for specified stationary sources with GHG emissions greater than 25,000 metric tons of CO_2e per year. This rule was established pursuant to the requirements of AB 32, and was intended to provide information to support the development of the Scoping Plan and its implementing regulations. At the time the Mandatory Reporting Rule was approved by the ARB Board, staff indicated that the Rule was not intended, nor did it include the level of detail necessary, to implement the cap-and-trade program (which, at that time, was not yet proposed). Applicable quantification protocols will be developed and approved by the ARB Board as part of its cap-and-trade regulation, as will a revised Mandatory Reporting Rule. More information about the ARB’s Mandatory Reporting Rule may be obtained at *http://www.arb.ca.gov/cc/reporting/ghg-rep/ghg-rep.htm*.

The U.S. EPA also has a Mandatory Reporting Rule. Under this rule, suppliers of fossil fuels or greenhouse gases that are used in industrial operations, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to EPA. The EPA rule does not currently specify quantification methods, and CAPCOA anticipates that any methods in this Report that would be applicable to affected reporters (e.g., building energy use) would be also be acceptable for use under the rule. Details on this rule can be found in 40 CFR Part 98, which was published in the Federal Register (*www.regulations.gov*) on October 30, 2009 under Docket ID No. EPA-HQ-OAR-2008-0508-2278.

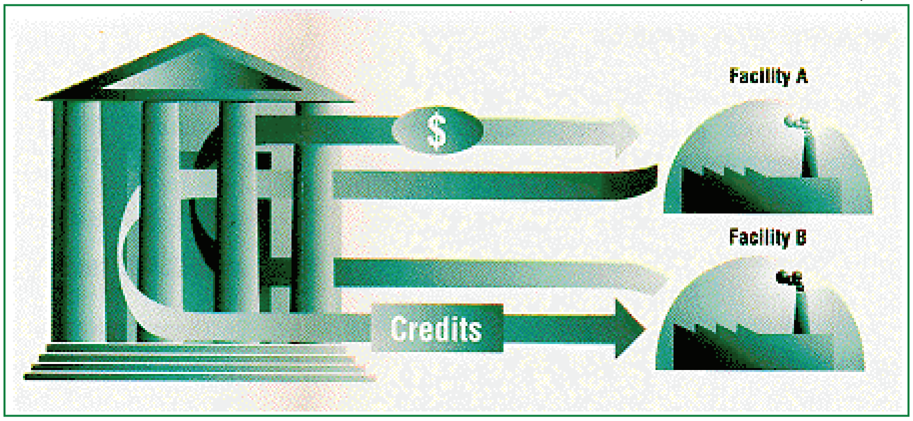
Reductions for Credit

There are several different ways to formally award credit for emission reductions. Emission reduction credits are used when the opportunity, desire, obligation, and the resources to implement reductions are not aligned. Sometimes an entity has the desire and opportunity to reduce emissions, but not the resources. Sometimes an entity is required to make reductions but has no viable project opportunities. Or funds may be available to implement project, but willing participants are needed. Systems are used to match up projects, proponents, funding, and, in some cases, compliance obligations, and the basis of the systems is emission reduction credits.

Concurrent Offsite Mitigation Projects: The simplest form of credit for emission reductions occurs when someone needs to reduce emissions to mitigate impacts (for example, under CEQA), but does not have a good opportunity within his or her own operation or project; but if a good opportunity is available at another operation the person who needs the reductions can fund that project in exchange for being able to take credit for the reduction. A variant of this can occur when a list of emission reduction projects that could be used for mitigation is maintained, and those projects are matched with people who need to implement mitigation. The key in this arrangement is that the project is directly funded by the person who needs mitigation, at whatever the cost the mitigation project ultimately has. The emission reductions occur, but are not traded as an independent commodity. The person who needs the mitigation remains obligated to ensure that the project is implemented and the emission reductions occur.

Mitigation Funds: Instead of matching the person needing mitigation with a project that is then directly funded by that person, it is also possible to collect the funding and then create the projects. In this case, funds are paid into a mitigation fund at a pre-established rate, and the operator of the fund is then obligated to find and implement emission reduction projects. The rate is typically set at a level (for example in dollars per ton needed) that is sufficient to implement an actual project to produce the emission reductions, based on data about actual project costs. As with concurrent offsite mitigation projects, the emission reductions here are not traded as an independent commodity, however a default rate is established. Under a mitigation fund, then, the person needing mitigation is considered to have provided it (that is, given “credit” for the reductions) at the point of paying into the mitigation fund. The obligation to ensure the emission reductions occur is transferred to the fund operator.

Emissions Trading: Emissions trading is a transaction that occurs between entities that make emission reductions which they don't need, and entities that desire emissions reductions but, for whatever reason, do not choose to make them. The emissions (or, more accurately, "credits" for the emission reductions) are treated as a commodity with independent value. The transaction occurs in some form of market, much as transactions occur between the grower of produce and the consumer in a local farmers market. The transaction, or trade, happens when a consumer believes that the product is worth the price being asked for it.



The obligation to ensure the emission reductions occur generally rests with the person selling the credits, and (to the extent an independent review has occurred) with whomever grants certification to the reduction project.

As explained above, a cap-and-trade program is a type of GHG trading market, but there are other types of emissions trading markets. An open GHG credit-based trading market does not have a cap, and participation is on a voluntary basis. In a credit-based market, credits are awarded for emission reductions, and may be purchased and sold as a commodity on an exchange. The credits are sometimes referred to as offsets, and they are generally tracked as tons, or metric tons, of pollutant reduced; in the case of GHGs, this is typically in the form of CO_2e. The important distinction between an open market and a cap-and-trade system is that the creation, buying, and selling of offsets is not restricted in an open market.

The following key terms and concepts are discussed to help the interested reader understand how credits are used in a trading market, It is not necessary to understand trading markets in order to use the quantification methods in this report, and the reader may proceed directly to Chapter 3.

<u>Regulators and Exchanges</u>: Some emissions trading markets are run by the government, while others are operated by independent, non-governmental entities. In government-run markets, such as the Regional Clean Air Incentives Market (RECLAIM) developed and administered by the South Coast Air Quality Management District, and U.S. EPA's Acid Rain program, a government agency establishes and implements the trading market. These markets are typically regulatory in nature, rather than voluntary, although some voluntary participation may be allowed. The Regional Greenhouse Gas Initiative (RGGI) implemented by ten Northeast and Mid-Atlantic states, and the

European Union Emission Trading Scheme (EU ETS) are other examples of regulatory markets.

Independent exchanges, such as the California Climate Action Registry (CCAR) and the Climate Registry (TCR), were established as independent, non-governmental operations. They offer a forum for entities to have emission reductions certified for credit, and for those credits to be bought and sold. These bodies develop their own structure and rules for participation. The nature of those rules determines the quality of the credits available on the exchange. Participation in the exchange is voluntary.

Standards for Credits: In order to be acceptable for credit under the AB 32 program, GHG emission reductions must be real, permanent, quantifiable, verifiable, enforceable, and additional. Historically, the federal Clean Air Act (CAA, or Act) has required emission reduction credits to be: real, permanent, quantifiable, enforceable, and surplus[7]. In this context, surplus means the reductions are not required by any law, regulation, permit condition, or other enforceable mechanism under the Act. California continued this concept in AB 32, requiring that any regulation adopted pursuant to AB 32 ensure that GHG reductions are "real, permanent, quantifiable, verifiable, and enforceable."[8]

The term "additional" comes from the Clean Development Mechanism in the Kyoto Protocol; it is essentially the same as "surplus" except that it is not restricted to any particular statute, and means that you cannot receive credit for any reductions that you were otherwise obligated to make. AB 32 requires its implementing regulations that include market-based compliance mechanisms to ensure that reductions are "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that might otherwise occur."[9]

Protocols: Transactions to purchase emission reductions depend on the confidence the purchaser has in the value of reductions being purchased. Price is part of the concept of value that we can easily understand. The other, less tangible part of the concept of value is the quality of the emission reductions themselves. This is harder to understand because, unlike the produce at the farmer's market, we can't examine the product to determine its value. Not only are emission reductions invisible, they actually *didn't happen*. So to have confidence in their value, we need a reliable and accurate picture of what *would have happened*, as well as what *actually happened*.

Protocols are the formalized procedures for accounting for credits that ensure the credits are an accurate and reliable representation of emission reductions that actually occurred. Some protocols focus only on quantification of the reductions, while others also address documentation and verification. They can be developed and adopted by regulatory bodies, by the operators of exchanges, or by subject area experts. Some markets will require participants to use a specific protocol or set of protocols. Others

[7] 40 CFR Sections 51.493 and 51.852
[8] California HS&C: Section 35862(d)(1)
[9] Ibid, Section 35862(d)(2)

will allow participants to propose a protocol for developing and quantifying reductions. Failure to follow required protocols may prevent the project from receiving credit.

Holding and Using Credits: When credits are awarded for emission reduction projects, the owner of the credits is generally given a certificate of value. In this case, "value" means the corresponding emission reductions, not the price, which is determined by the market. The credits are registered with a bank where they are kept until the owner of the credits uses or sells them.

Credit Banks: Emission credit banks are similar to savings banks where money is deposited. The bank tracks credits, credit value, credit price, and transactions. It compiles data and issues reports. Banks are subject to accounting standards and requirements for transparency. It is important to note that not all credits can be banked. Credits or allowances that have a finite life do not retain their value beyond their life term.

Credit Life: Credits may have a specified life (for example, one year), or they may be permanent. The life of the credit may be dictated either by the nature of the reductions that generated it, or by the program in which it is being used. As discussed above, in California, AB 32 requires reductions for regulatory compliance to be permanent. In other markets, such as Kyoto's Clean Development Mechanism, there are both long term and short term credits.

Discounting Credit Value: Some regulatory structures require that credits be discounted, that is, the emission reduction value of the credit (not the price) is reduced to account for certain factors, or to enhance the liquidity of the market. In some cases, a portion of the credit value is surrendered or retired in the interest of environmental policy goals.

Offset Ratios: Offset ratios are a way to ensure an adequate margin of safety when credits are provided to offset impacts. A program may require that the amount of credits provided is greater than the anticipated emissions increases. If the program requires 10% extra credits, then the offset ratio is said to be "1.1 to 1."

The above discussion of emission reduction credits and trading is provided for information only, and should not be construed as endorsement of, or recommendation for, the use of credits or trading for the purposes of meeting GHG reduction obligations. CAPCOA does not make policy recommendations regarding credits or trading in this Report. Decisions about whether to allow the use of credits rests solely with the agency with jurisdiction over a project or program.

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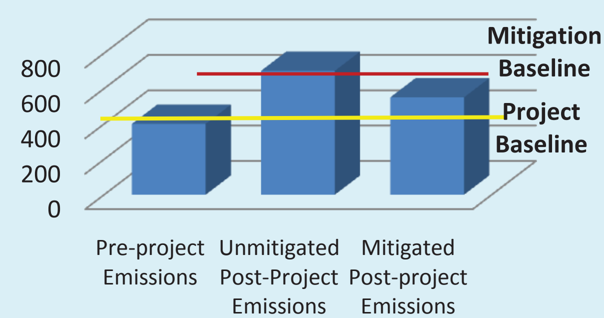
This chapter provides an overview of some key concepts that arise in considering quantification of GHG emission reduction projects. This discussion is provided so the reader understands the context in which these terms are used throughout this document. Here again, this discussion is not intended to endorse any policy position, nor does it provide any recommendations on thresholds of significance for GHG emissions. Policy decisions are left to individual agencies and their governing boards.

Baseline

An emissions baseline is the foundation of any estimate of the impacts of a project or of a mitigation measure. In its simplest form, it reflects the current level of emissions if those emissions do not vary. Usually, however, emissions do vary, typically because the activities or operations that cause the emissions change. Traffic patterns change with the time of day, ski areas are busiest in the winter, air conditioners run more in the summer, people drive less when fuel prices rise, and production of goods changes with the economy. To set a baseline, it is important to understand what factors affect the activity or operation in a way that will alter its emissions; then, the most appropriate scenario is selected and the emissions are adjusted to account for that scenario. Figure 3-1: Baseline illustrates the concept of baselines in project analysis.

Figure 3-1: Baseline



Regulatory programs that require calculation of emissions baselines generally specify the basis for the calculation. For example, a baseline scenario could be a three year average of actual emissions, or the worst case, or, as in CEQA, the program may call for an analysis to identify a representative set of conditions based on historical data.

In its proposed draft regulation for cap-and-trade, ARB defines baseline to mean "the scenario that reflects a conservative estimate of the business-as-usual performance or activities for the relevant type of activity or practice such that the baseline provides an adequate margin of safety to reasonably calculate the amount of GHG reductions in reference to such baseline."[1]

For this Quantification Report, CAPCOA selected a baseline period to correspond to the average GHG emissions from 2002 to 2004, inclusive. This is the emissions baseline period used by ARB in its Scoping Plan[2]. The baseline conditions used to quantify the

[1] ARB: "Preliminary Draft Regulation for a California Cap-and-Trade Program," Section 95802 (a)(2), Dec., 2009; page 5.
[2] ARB: "Climate Change Scoping Plan: a framework for change," Dec., 2008; page 11.

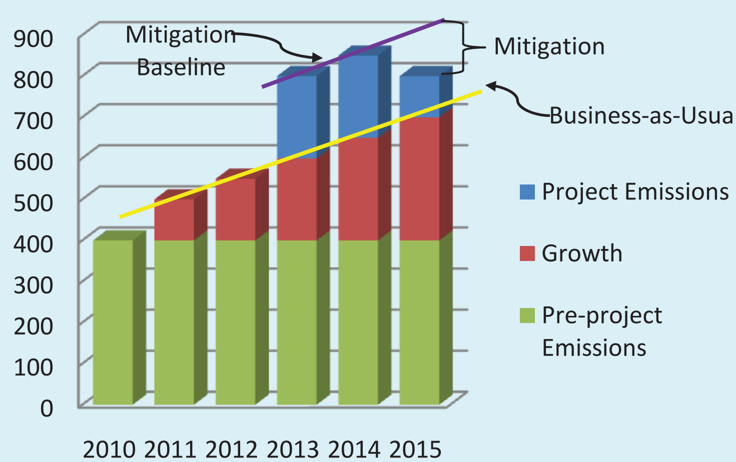
effectiveness of mitigation measures for this Quantification Report reflect the conditions that formed the basis for ARB's 2007 inventory of economic activity and GHG emissions. Those conditions and the associated quantification methods are explained in Appendix B to this Report. A copy of ARB's Scoping Plan may be downloaded at: *http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm*.

There may be circumstances in which a different set of baseline conditions is more appropriate. If a user wishes to adjust the baseline, CAPCOA recommends using the methods provided in the measure Fact Sheet, and in Appendix B, but substituting data inputs that better reflect the baseline conditions for the project under consideration. This ensures consistent methods are used so the comparison of baseline to project is an "apples-to-apples" comparison. So, for example, a user outside of California would substitute an emission factor for electricity generation that better represents the generation mix that is provided in the user's region. This alternative factor would be used in the baseline methods where electricity generation is part of the calculation, and would also be used in the quantification of emissions associated with the project.

It may also be appropriate to adjust the baseline conditions on a temporal basis if needed to account for changes over time. The ARB revises its emissions inventory information on a periodic basis. The most current inventory information was published in May of 2010, and covers the time period from 2000 to 2008. The information is available by category, with trends analysis, and with full documentation of data sources and methods. The updated emissions inventory information is available at: *http://www.arb.ca.gov/cc/inventory/data/data.htm*.

Business-as-Usual Scenario

Figure 3-2: Business-as-Usual



Not all baseline conditions occur in the present. In some cases, the baseline is a forecast of the conditions that are expected to exist at some time in the future, in the absence of interventions to change those future conditions. The forecasted baseline conditions are referred to as "business-as-usual" and are intended to reflect normal operation. For example, a town might currently have 20,000 residents, and be on a course to to add another 5,000 residents in low-density, planned development at the perimeter of its existing footprint over the next 10 years. The town could add an urban growth boundary that would change that anticipated development. In order to quantify the effect of adding the urban growth boundary, the business-as-usual growth scenario must first be calculated; that will form the baseline to compare to the growth scenario with the adopted boundary. Figure 3-2 illustrates the application of the "business-as-usual" concept to a project.

ARB defines business-as-usual to mean, "the normal course of business or activities for an entity or a project before the imposition of greenhouse gas emission reduction requirements or incentives."[3]

Mitigation Types

There are four general ways to create emission reductions for mitigation projects: (1) the operation or activity can be avoided so that emissions are not created in the first place; (2) the operation or activity can be changed so that it creates fewer emissions; (3) emission control technology can be added to the activity or operation that prevents the release of emissions that are created; and (4) emissions that have been released can be sequestered in the environment. Each of these is discussed below.

Avoided Emissions: When someone chooses to walk to the grocery store in lieu of driving, or turn off the lights, energy isn't needed to power the car or lights, and the emissions associated with that energy don't occur. In the case of walking instead of driving, the avoided emissions include the CO_2 and other pollutants that would have come from the tailpipe of the car. These are "direct" emissions that are being avoided, and they can be readily quantified to show the benefit associated with walking. When electricity isn't needed, it isn't generated; the avoided emissions are the CO_2 and other pollutants that are not emitted by the power plant. Because the emissions are not directly emitted where the light is being used, this type of emissions are referred to as "indirect" emissions; even though they are indirect, they can still be quantified to show the benefit of turning off the lights. There can be other benefits associated with avoided emissions as well. When you consider the walking scenario in a lifecycle sense, the avoided emissions can also include the energy that would have been used to extract, refine, transport, and dispense the fuel. The same is true when you use a reusable cloth bag instead of a disposable plastic bag to carry your purchases; energy is needed to extract and refine the petroleum that goes into the bag, to make and transport the bag, and then to dispose of the bag after it is used. These kinds of avoided emissions are much more difficult to fully quantify, however, and will not be included in the quantification approaches in this document. Even if we aren't quantifying the benefits, however, it is important to understand that avoided emissions can have positive effects both upstream and downstream, creating a ripple effect of further avoided emissions.

[3] ARB: "Preliminary Draft Regulation for a California Cap-and-Trade Program," Section 95802 (a)(18), Dec., 2009; page 7.

Fewer Created Emissions: If the activity or operation can't be avoided, sometimes it can be accomplished in a way that creates fewer emissions. This is usually associated with increased efficiency. So, for example, if walking to the store isn't an option, someone could choose to drive there in a more efficient vehicle, like a gas-electric hybrid powered car. The engine in the hybrid is able to drive more miles with less fuel consumed. Less fuel consumed equates to fewer emissions at the tailpipe. In the lighting example, using a more efficient light bulb is one way to reduce the indirect emissions, but a more efficient power plant would also do this.

Controlled Emissions: Once emissions are created, they are either released to the environment, or they are controlled with technology that captures and stores or destroys them. In the car example, the addition of a catalytic converter allows the tailpipe emissions to be collected after they are created, and destroyed before they are released. Note that the efficiency of the engine (discussed above), and the control of emissions after they leave it, are two distinct ways to reduce emissions. There are also emissions control technologies for power plants.

Sequestration of Emissions: Carbon emissions are "sequestered" by embedding the carbon in structure that will hold the emissions and keep them out of the atmosphere. Sequestration happens through biological, chemical, or physical processes.

<u>Biological Sequestration</u>: Trees and other vegetation biologically absorb carbon from the atmosphere and incorporate it into their biomass; the carbon becomes the solid form of the growing tree or plant. Many sequestration projects involve the planting of trees or vegetation to improve the uptake of carbon from the atmosphere. Enhanced farming practices may also achieve some sequestration through the use of CO_2 absorbing cover crops, improved grazing practices, and restoration of depleted land. Increased peat production in peat bogs is also method to biologically sequester carbon.

<u>Chemical Sequestration</u>: Oceans absorb CO_2, and it causes the oceans to become more acidic (which is detrimental to coral reefs and other sea life). Other chemical processes include reacting CO_2 through a process called mineral carbonation to form stable carbonate minerals that are normally found in the earth's crust.

<u>Physical Sequestration</u>: CO_2 can also be physically contained in a way that prevents its release to the atmosphere. This can involve injecting it deep into the ground, for example into depleted oil and gas reservoirs. It can also be injected into oil wells to push up the oil. Another approach is to embed it in cement through a newly developed process that causes cement to absorb CO_2 from the atmosphere while it is curing.

Measure or Project Scope

Just as good quantification requires careful and transparent consideration of the baseline or business-as-usual scenario, it also requires a complete and detailed characterization of the measure or project being undertaken. This is important because considerations of what is included in, and what is excluded from, the analysis can have a significant impact on results of the quantification.

Determining the appropriate scope for the analysis of a project or measure is not always as simple as it might appear. Take for example the installation of solar panels in a remote desert region that receives a lot of sun. The panels generate electricity without releasing GHG emissions, which offset more traditional generation of electricity that does emit GHGs. But the desert region may be prone to dust or sand storms, which would quickly obscure the glass panels and decrease their effectiveness. This decrease could be minimized if the panels were cleaned regularly. But the cleaning will require vehicles to come to the site, which takes energy and releases GHGs, and the cleaning activity itself may do so as well. If the site is truly remote, the emissions from those vehicle trips could be large. But what if there is another installation nearby: can the trip-related emissions be considered only in addition to those for the other site? Do you have to know if the cleaning for both sites can be accomplished in one trip? And what about the energy and materials needed to make the solar panels?

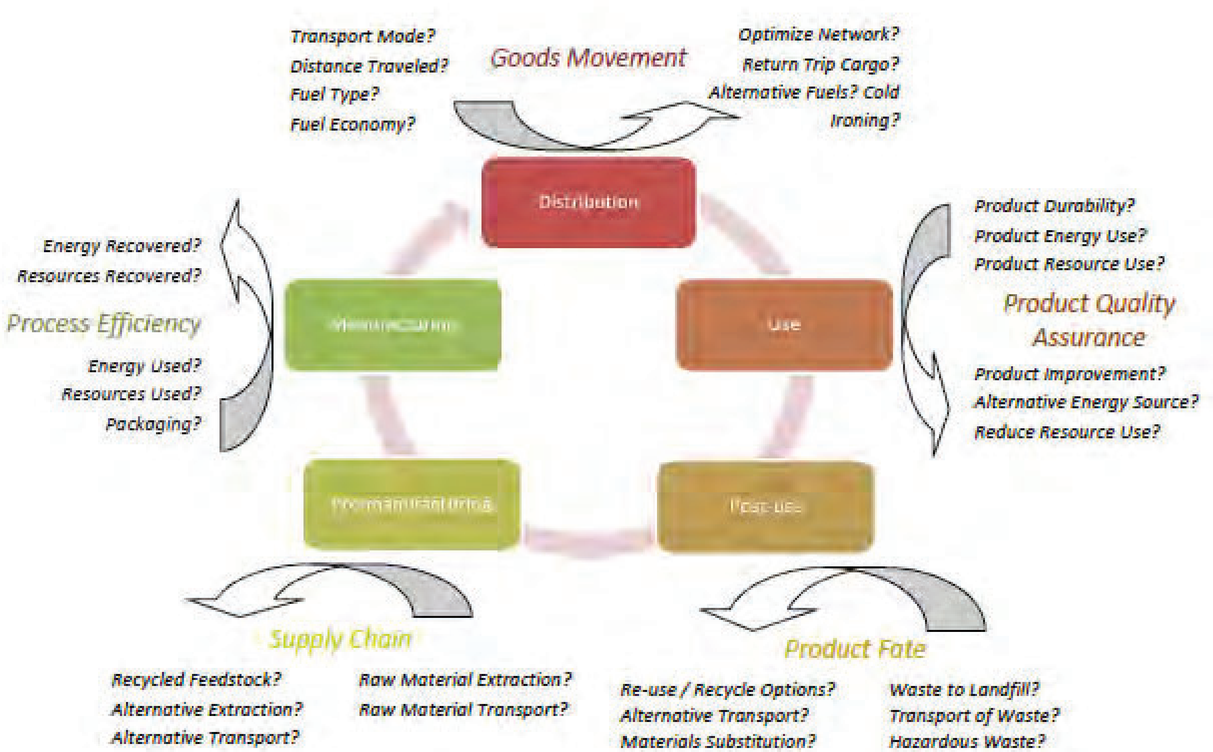
The methods in this Report generally include those reductions over which a project proponent can exercise direct control, as well as indirect emissions associated with electrical generation and the use of natural gas. CAPCOA does not include analysis of full lifecycle emissions in this Report, because of the complexity of the analysis involved and the lack of general standards for incorporating such considerations.

Lifecycle Analysis

Energy and materials are involved in the creation, processing, transport, and disposal of all of the products we use, from the tomatoes on our salads, to the computers we work with, the vehicles we drive (even if they are zero-emission vehicles), and the roadways we travel over. A lifecycle analysis attempts to identify and quantify the GHG emissions associated the energy and materials used at all stages of the product’s life, from the gathering of raw materials, through the growing or fabrication, distribution, use, and the ultimate disposal at the end of the product’s useful life.

This is a difficult and complicated undertaking; it is challenging to identify all of the inputs that are both necessary and meaningful for this sort of analysis. Even if the inputs can be identified, good data are not readily available to quantify emissions in most cases. Further, there is not yet agreement on methodological approaches to lifecycle analysis for most sectors (Figure 3-3: Lifecycle Analysis shows a basic schematic of some of these considerations.). For these reasons, as stated under the discussion of scope, above, CAPCOA does not include lifecycle analysis in this Report.

Figure 3-3: Lifecycle Analysis



Unfortunately, there are important mitigation projects or measures that cannot be quantified without a lifecycle analysis, and some of them are measures that are highly desirable or commonly encouraged. One example is the recycling and reuse of construction materials; it is intuitively obvious that recycling and reuse avoids both the embedded energy costs in the new material, as well as the energy and emissions associated with disposal. Another example is the push for reusable cloth grocery bags instead of disposable plastic ones, or reusable water bottles filled with tap water instead of disposable bottled water. For some of these measures, it is possible to do a limited lifecycle analysis, if the project scope is well defined and if the data are available. The Report provides a discussion of how to pursue an analysis in such cases, but otherwise identifies these kinds of measures as Best Management Practices.

It is important to note that Appendix F to the CEQA Guidelines Amendments approved in December of 2009 specifically state that a lead agency is not required to perform a project-level energy life-cycle analysis[4]. Because direct GHG emissions from electrical generation, and GHG emissions from electricity associated with water use (as well as other direct emissions associated with water treatment) are well defined and can be

[4] California Natural Resources Agency: Adopted Text of the CEQA Guidelines Amendments (Adopted December 30, 2009, Effective March 18, 2010), Appendix F.

accurately quantified, they are not considered to "lifecycle emissions" for the purposes of this Report, and they are included in these quantification methods.

Accuracy and Reliability

In an effort to standardize the creation of GHG inventories, and improve the quality of the information, the IPCC defines "good practice" for GHG emissions quantifications as those that "contain neither over- nor under-estimates so far as can be judged, and in which uncertainties are reduced as far as practicable."[5]

Part of the challenge in developing methods that meet this standard of good practice is assuring the accuracy of the methods. CAPCOA uses accuracy to mean the closeness of the agreement between the result of a measurement or calculation, and the true value, or a generally accepted reference value. When a method is accurate, it will, for a particular case, produce a quantification of emissions that is as close to the actual emissions as can practicably be done with information that is reasonably available.

To meet the good practice standard, the quantification methods must also be reliable, which is different from being accurate. A reliable method will yield accurate results across a range of different cases, not only in one particular case.

To some extent, the accuracy of the quantification is sacrificed to achieve reliability. This is because a method that can be applied across a range of scenarios must be generalized to some extent. So, for example, the transportation analyses do not, for the most part, differentiate between peak and off-peak vehicle trips, even though off-peak trips will have a lower emission impact because of the effects of congestion on travel time and engine performance. In order to fully address all of the factors that impact the emissions associated with vehicle trips in a specific project, a far more detailed and costly analysis would be needed, and it would not be readily applied to other situations. The methods contained in this Report have been developed to provide the best balance between accuracy and reliability, bearing in mind that ease of use is also important.

In order to ensure both the accuracy and the reliability of the quantification methods in this Report, each method is accompanied by a discussion of the assumptions and limitations of the method. Where either the assumptions are not met, or the limitations are exceeded, the method will not be accurate, and the error can be very large. Further, if the conditions of the project differ from the assumptions and limitations of the method, the quantification may no longer be applicable. It is possible to look at the underlying assumptions and calculation and make adjustments to the method so that it better reflects the conditions of a specific project. Doing this may preserve the accuracy to some extent, but the user is responsible for determining how best to accomplish this, and the reviewing agency will decide whether the results are still acceptable.

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[5] IPCC 2006, "2006 IPCC Guidelines for National Greenhouse Gas Inventories," Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds).Published: IGES, Japan. Page 1.6.

Additionality

In order for a project or measure that reduces emissions to count as mitigation of impacts, the reductions have to be "additional." Greenhouse gas emission reductions that are otherwise required by law or regulation would appropriately be considered part of the existing baseline. Thus, any resulting emission reduction cannot be construed as appropriate (or additional) for purposes of mitigation under CEQA. For example, in the draft regulation for cap-and-trade, ARB specifies that in order to be eligible for offset credit, "emission reductions must be in addition to any greenhouse gas reduction, avoidance or sequestration otherwise required by law or regulation, or any greenhouse gas reduction, avoidance or sequestration that would otherwise occur."[6] What this means in practice is that if there is a rule that requires, for example, increased energy efficiency in a new building, the project proponent cannot count that increased efficiency as a mitigation or credit unless the project goes beyond what the rule requires; and in that case, only the efficiency that is in excess of what is required can be counted. It also means that if there is a rule that requires a boiler to be replaced with one that releases fewer smog-forming pollutants, and the new boiler is more efficient and also releases less CO_2, the reduced CO_2 can't be counted as mitigation or credit, because the reductions were going to happen anyway. But if the boiler were replaced with a solar-powered water heater, the difference in emissions between a typical new boiler and the solar water heater could be counted.

From a practical standpoint, any reductions that are *not* additional have to be either included in the baseline or subtracted from the project, whichever is more appropriate. In preparing this Report, CAPCOA made determinations about requirements to include in or exclude from the baseline. A more complete discussion of those determinations is included in Appendix B.

Verification

Verification is the process by which we demonstrate that the emission reductions we have quantified for a project actually occurred. While not important for purely voluntary projects, verification in some form is a necessary step in most other circumstances. Verification is an important component in establishing the value of reductions that are made. It allows others to have confidence in the quality of the reductions. If the reductions are being made to satisfy an obligation to mitigate impacts, the agency with jurisdiction should be consulted to determine what standard of verification is needed. In some cases, independent, third-party verification is required. Not all regulatory programs specify third-party verification, however. For example, the U.S. EPA's Mandatory Reporting Rule relies instead on routine compliance verification through a permit system.

[6] ARB: "Preliminary Draft Regulation for a California Cap-and-Trade Program," Section 95802 (a)(4), Dec., 2009; page 6.

This chapter of the Report provides an explanation of how the quantification methods were developed, and the limitations of the sources used. There is also an overview of the presentation of the quantification methods in the Report. Finally this section discusses the limitations of the methods themselves, and how these limitations should be considered when applying the methods to actual mitigation projects.

General Emission Quantification Approach

The emission quantification methods in this Report are designed to provide GHG estimates using readily available, user-specified information for a source or activity. In general, GHG emissions associated with a given source or activity are estimated using data for a physical quantity or metric, on the underlying assumption that CO_2 emissions are directly proportional to that metric. For example, emissions related to vehicles are estimated using vehicle trips and mileage data. For sources of indirect emissions such as buildings, swimming pools, municipal lighting and water distribution, the metric is energy use as electricity or natural gas[1]. When site-specific energy use data are not available, energy use can be estimated using a physical metric such as the volume of water supplied, the size of building, and the number of lamps.

For each source metric there are emission factors that quantify the amount of emissions released as a result of the source or activity. These emission factors have been developed by various governmental agencies, public utilities and other entities though data analysis and numerical models. The factors are based on certain assumptions that define the typical or "baseline" emissions scenario. For example, emission factors for vehicles assume a particular type of fuel and driving speed, and emission factors for electricity use assume a certain mix of electricity generating methods. .

Individual GHGs are converted to carbon dioxide equivalent units by multiplying values by their global warming potential (GWP). The GWP values used in this report are based on the IPCC Second Assessment Report (SAR, 1996), even though more recent (and slightly different) GWP values were developed in the IPCC's Third Assessment Report (TAR, 2001) and Fourth Assessment Report (FAR, 2007). The values in the SAR were used in this Report because they are still used by international convention.

The general equation for emissions quantification is shown below for each GHG:

$$\text{GHG Emissions} = [\text{source metric}] \times [\text{emission factor}] \times [\text{GWP}]$$

Then, all GHGs are summed from an individual source.

$$\text{GHG Emissions}_{total} = \sum_{n=1}^{i} [\text{GHG Emissions}]_n$$

[1] Note that emissions from natural gas use are not always indirect in nature. For more discussion of direct and indirect emissions and types of mitigation, please see Chapter 3.

Where “source metric” and “emission factor” are defined as follows:

Source Metric: The “source metric” is the unit of measure of the source of the emissions. For example, for transportation sources, the metric is vehicle miles traveled; for building energy use, it is “energy intensity”, that is, the energy demand per square foot of building space. Mitigation measures that involve source reduction are measures that reduce the source metric. This can include for example, reducing the miles traveled by a vehicle because the reduction in miles traveled will reduce the emissions generated from vehicle travel. Similarly, a reduction in dwelling unit electricity use by installing energy efficient appliances and lighting will reduce the emissions associated with total electricity assigned to dwelling units.

Emissions associated with source reduction measures are generally avoided emissions. As discussed in Chapter 3, there are often additional benefits to these kinds of reductions. Source reduction promotes efficient use and management of resources and utilities, in addition to avoiding emissions. Thus, source reduction can also result in a decreased need for downstream emissions control. From a quantification standpoint, for this type of measure, it is the “source metric” in the basic emissions equation (above) that changes.

Emission Factor: The “emission factor” is the rate at which emissions are generated per unit of source metric (see above). Reductions in the emission factor happen when fewer emissions are generated per unit of source metric, for example, a decrease in the amount emissions that are released per kilowatt hour, per gallon of water, etc. Such a decrease may apply if a carbon-neutral electricity source (e.g. from photovoltaics) is used in place of grid electricity, which has higher associated emissions; or if electricity is used instead of combustion fuel, such as with electric cars. Reductions can also occur if a fuel with lower GHG emissions is used in the place of one with higher GHG emissions. From a quantification standpoint, for this type of measure, it is the “emission factor” in the equation that changes.

For both kinds of measures, mitigated emissions are calculated using the same general equation, but the emissions will change based on whether the values change for the source metric or the emission factor. Several mitigation measures may apply to the same source, changing both the source metric and the emission factor, and the estimation of the overall impact of simultaneous measures must be carefully evaluated. In some cases the reductions are additive, but in others they must be evaluated sequentially. Other sets of mitigation measures may require additional analysis to avoid double-counting. Furthermore, not all types of mitigation measures will be feasible in all situations. Chapter 6 provides a detailed discussion of considerations in quantifying the combination of mitigation measures, as well as a set of rules to guard against over-estimation of reductions.

Quantification of Baseline Emissions

In order to ensure that similar assumptions and methodologies are being used to quantify both the baseline and project emissions, a consistent set of methodologies for determining the GHG emission baseline emissions was defined. This was the first step in establishing quantitative methods for assessing GHG mitigation reductions. The results of this effort are contained in Appendix B and should be utilized or considered when establishing baseline emission levels. This same set of methodologies was used to develop the quantification methods for each mitigation measure.

Quantification of Emission Reductions for Mitigation Measures

There is a wide array of mitigation measures that could reduce direct or indirect GHG emissions for a project; however, not all of them can be readily quantified with the information and tools currently available. Other measures may be individually quantifiable, but the quantification cannot be reliably extrapolated to other similar projects. The goal in developing this Quantification Report was to provide accurate and reliable methods that can be easily applied across a range of projects and settings. This section explains how the list of measures included in this guidance was developed, and how the measures are presented.

Screening of Mitigation Measures: An initial list of candidate measures was developed with about 75 types of greenhouse gas mitigation measures related to site design, land use, building components, parking measures, energy, solid waste management, etc. These were identified because they were commonly seen in land use permit applications or were measures that air districts have been frequently asked for guidance on. A literature review was done to identify potential additional measures.

Measures from this compiled list were screened based on the following criteria:

- Relevance to project-level CEQA analysis;
- Availability of empirical evidence or reliable research to credibly establish baselines and level of effectiveness; and
- Non-negligible level of effectiveness determined by credible research.

Measures or grouped measures that did not meet all three of these criteria were evaluated for the possibility of grouping measures with synergistic effects or describing as a Best Management Practice (BMP). Where measures were determined to be BMPs, the Report describes the relevant literature and, where applicable, provides methods that could be used if substantial evidence is available to support the reduction effectiveness. In addition some measures had substantial evidence of reductions when implemented at a general Plan (GP) level rather than a project level. These measures were retained as applicable for General Plans, only. Local Agencies may decide to provide incentives or allocate the General Plan level reductions to specific projects by weighting the overall effect by the number of projects to which the General Plan reduction would apply.

Information Sources and Their Limitations: The quantified effect that different mitigation measures have on source quantities or emission intensities must be based on substantial evidence and should be enforceable (to ensure that the commitments are adhered to) and verifiable (to confirm that the mitigation measures were implemented).

Examples of credible sources for supporting evidence include government agency-sponsored studies, peer-reviewed scientific literature, case studies, government-approved modeling software and widely adopted protocols. In order for the supporting evidence or data for a given mitigation measure to be deemed applicable, it must be based on similar or scalable assumptions and conditions in terms of period of study, physical scale, site-specific parameters, operating conditions, technology, population type, etc.

There are uncertainties associated with any type of estimation method. Some of these methods attempt to predict future behavior with respect to water and energy use using historical data and trends, which may not accurately reflect changes in behavior due to increasing awareness of resource conservation. Despite these uncertainties, the methods presented in Chapter 7 provide the best available estimations of GHG emissions and are therefore suitable for the project-level inventories.

Enforceable Reductions: As discussed in Chapter 2, emission reductions (whether as mitigation under CEQA, for regulatory purposes, or for trading) have to be enforceable. For that reason, in this Report the quantity of reductions or applicability of mitigation measures is limited to elements which the project proponent can control. Additional reductions in GHG emissions may be feasible in the broader sense and may occur; however, because the project proponent does not have control over these elements, those other reductions are not considered in the quantification methods here.

For instance, in the context of a building project, source reductions that rely on individual occupant behavior are generally not enforceable by the builder. A residential dwelling, when occupied, will contain a variety of electrical appliances. An individual occupant may decide to purchase energy efficient appliances and would therefore reduce energy use. This reduction in energy use is not enforceable, however, because the project proponent can’t dictate individual occupants’ purchases; these types of reductions are not counted in the methods in this Report. There may be some instances, however, where the project proponent is the occupant and would have the ability to enforce behavior. In these instances additional emission reductions not quantified in this document may be feasible and enforceable.

Some reductions in emissions are not enforceable when voluntary, but become enforceable when implemented as part of a regulatory scheme. Once regulations that result in emissions reductions are enacted, the project should be reviewed to determine how the requirements affect the baseline, and the reductions that can be quantified for mitigation credit.

When the emission reductions from a project are not enforceable, and therefore not quantified under these protocols, they may still have value for mitigation purposes and a qualitative analysis should be considered. Decisions about whether such reductions will be considered, and what sort of qualitative analysis is appropriate, are the responsibility of the agency reviewing the project.

Creation of Mitigation Measure Fact Sheets: Once the list of mitigation measures was determined, detailed Fact Sheets were developed for each mitigation measure. Each fact sheet presents a summary of the measure's applicability; the required calculation inputs from the actual project; the baseline emissions method; the mitigation calculation method and associated assumptions; a discussion of the calculation and an example calculation; and finally a summary of the preferred and alternative literature sources for measure efficacy. The fact sheets begin with a measure description. This description includes two critical components: (1) specific language regarding the measure implementation (which should be consistent with the implementation method for the actual project), and (2) a discussion of key support strategies that are assumed to also be in place for the reported range of effectiveness. Chapter 6 provides a discussion of the Fact Sheets and a brief description of their intended use. The Fact Sheets themselves are included in Chapter 7.

Quantification Methods

In this Report, emissions reductions are presented in terms of percentage reductions. For mitigation measures where the source metric is reduced, reductions were generally assessed based on a ratio comparison of a common "denominator" source metric for each source category in order to assist in the quantification of strategy impacts:

- Building Energy Use will utilize natural gas and electricity use.
- Water will utilize outdoor and indoor water use.
- Solid waste will utilize waste disposed.
- Mobile sources will utilize changes in vehicle miles travelled (VMT).

For mitigation measures involving emission factor reductions, a ratio comparing the mitigated and baseline emissions factor is utilized to quantify the emission reductions.

Because a ratio comparison is utilized, in most cases the reductions quantified for GHGs will also be the same reduction assessed for criteria pollutants and toxic air contaminants provided the reduction in emission factors also occurs for the other types of pollutants. This is not always the case and in some cases a reduction for one pollutant may result in an increase for another pollutant.

There is one exception to the quantitative approach described above, for off-road and on-road vehicles that affects the quantification of the emissions of ROGs. The underlying data and methods available to quantify these emissions were limited to running emissions (that is, emissions from the tailpipe while the engine is running). There are also evaporative emissions, however, which occur when pollutants evaporate from the fuel in the fuel tank and escape to the atmosphere. The evaporative emissions of most pollutants are very small when compared to the running emissions, but evaporative emissions of ROGs are not small compared to the running emissions. Because the underlying data and methods available did not address evaporative emissions, they are not part of the emission factor ratio and must be accounted for separately. Accordingly, an estimate of the ratio of running to evaporative emissions for ROGs was determined and used to adjust the reductions for ROGs from vehicles.

Limitations to Quantification of Emission Reductions for Mitigation Measures

In order to properly apply the quantification methods in this Report, it is important to understand the limitations of the methods. The following discusses the limitations of the underlying data and methods used to develop the quantification in this Report. A discussion of the limits on applying the methods in the Report is contained in Chapter 6. Further, the Fact Sheet for each individual measure identifies specific limitations and considerations that affect the application of that particular measure.

Prediction of Future Behavior: In order to assess the emissions associated with a project that does not yet exist, it is necessary to make assumptions regarding anticipated amounts of energy use, VMT, water use, etc, that will characterize the project once it occurs. These values may be based on estimates of source metrics from surveys of current values for those metrics, or from recent historical values. When such data are used, they are typically assumed to remain constant when applied to the project unless a there is a specific action (such as the application of a mitigation measure) that would alter the value(s). Although this is a commonly accepted practice, in reality, current behavior is not likely to remain constant over time in the way it is assumed. For instance, the occupant of a building determines the set point of thermostats, the duration of showers, and the usage of air conditioning, among other things. The project proponent will have little, if any, influence over these choices made by the future occupants.

Understanding the limits of these predictions, they are still the best basis for estimating future behavior. For this Report, quantification was based on current median behavior attributes. The limitations of the predictions can be minimized, however. Information about what influences behavior in specific circumstances is often available. Where data are available to show the relationship between external factors and the source metrics used to quantify a particular measure (such as fuel prices and VMT, for example), and more specific information is available about those external factors to predict future trends, that information could be used to further refine the quantification presented here. Again, the quality of the data used will substantially affect the accuracy and reliability of the results. It is also important to be aware of, and to minimize if possible, the error that can result from combining data from different sources (see below).

Combination of Data Sources: The quantification of some of the measures in this Report required the use of multiple sources of data. Any time data are derived from different sources there may be slight discrepancies the underlying in methodologies and data set characteristics; when the information between two data sets is combined, the discrepancies may affect the ultimate quantification of emissions, either over- or underestimating them. For example, some energy efficient appliances were not directly called out in the study of primary energy use based on end use. To obtain information on specific end uses, a secondary source was consulted that quantified energy use by end uses, and the values from this study were used to provide the detail where the end use data were lacking in the first study. It is not possible to determine the precise magnitude of the error that combining these two data sets induced in the final quantification, however every effort was made to minimize potential errors through thorough review of available data and exclusion of incompatible data sets.

There may be data sets available when considering a specific project that address the particulars of the project but are not generally applicable. Such case-specific data could be substituted for the more general data used to develop the quantifications in this Report. If such a substitution is considered, it is important to understand that it can result in an error in the quantification of the mitigation measure reductions because the methods used to derive the case-specific data may contain different assumptions that are not considered in, or are not consistent with the mitigation measure as characterized in the Fact Sheet. Anyone proposing the use of alternative underlying data for source metrics or emission factors must have a good understanding of the assumptions used in estimating the metrics/factors used in the baseline methodology and measure quantification for this Report. The discussion of sources and methods in the measure Fact Sheets as well as the baseline methodology in Appendix B should provide sufficient information to make this assessment.

Understanding these caveats, use of source-specific data is generally an improvement over that of generalized data, and where good quality source-specific data are available, they should be used. CAPCOA will not be able to review case-specific changes to the methods in this Report; however, the local air district may be able to provide assistance or recommendations. The decision to allow alterations to methods, including substitution of underlying data sets, rests with the agency reviewing the project.

Projects That Involve More Than One Mitigation Measure: Each mitigation measure was quantified using a specific set of underlying data and assumptions, and will provide the most accurate and reliable results when the project precisely matches the description of the measure, with all of its assumptions and limitations. In reality, projects may differ from the described measures, or may involve the application of more than one measure. In order to ensure that the resulting quantification is appropriate and accurate, specific procedures are provided in Chapter 6 for combining mitigation measures.

Lack of Detailed Information: The quantification methods provided in this report have been developed to allow them to be applied to a range of project conditions and still yield accurate and reliable results. In order to do this, the methods require data inputs that reflect the specific conditions of the project. Because the project has not yet been completed, however, certain information about the project will not be known and must be either estimated or assumed based on standard procedures. For example, at the time of the CEQA process a project proponent might know the number of residential dwelling units that will be in the project, but not know the actual square footage individual units will have. Similarly, while the project proponent may know a general type of non-residential land uses planned, these are often generalized categories such as retail and do not reflect the true diversity and range of source category parameters that would occur between the specific types of retail that the project eventually has. Nor can a project proponent predict specific appliances that will be in buildings or frequency of use. Further, most projects rely on generalized trip rate and trip lengths information that are not specific to the project; these estimates may over or underestimate the actual trip rates and trip lengths generated by the project. In each of these cases, estimates of future conditions are made based on accepted procedures and available data. This Report does not provide, or in any way alter, guidance on the level of detail required for the review or approval of any project. For the purposes of CEQA documents, the current CEQA guidelines address the information that is needed.[2]

The lack of precise and accurate data inputs limits the quality of the quantified project baseline and mitigated emissions, however. This limitation can be minimized to the extent the project proponent is able to provide better predictive data, or establish incentives, agreements, covenants, deeds, or other means of defining and restricting future uses to allow more precise estimates of the emissions associated with them. Some of these means of refining the data may also be creditable as mitigation of the project. The approval of any such enhancements of the data, or credit as mitigation, is at the discretion of the agency reviewing the project.

Use of Case Studies: One method of enhancing the data available for a project is the use of case studies. Case studies generally have detailed information regarding a particular effect. However, there are limitations of using this information to quantify emissions in other situations since adequate controls may not have been studied to separate out combined effects. There may be features or characteristics in the case-study that do not translate to the project and therefore may over or underestimate the GHG emission reductions. For the most part, case studies were not used as the primary source in the development of the quantification methods in this report. Where case studies were used to enhance underlying data, the studies were carefully reviewed to ensure that appropriate controls were used and the data meet the quality requirements of this Report.

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[2] See: California Natural Resources Agency: 2007 CEQA Guidelines – Title 14 California Code of Regulations, Sections 15125, 15126.2, 15144, and 15146.

Extent Reductions Are Demonstrated in Practice: Some of the GHG mitigation measures in this Report are open-ended with regards to the amount of reductions that are theoretically possible. There are, however, practical limitations to the amount of reductions that can actually be achieved. These limitations can include the cost to implement the measure, physical constraints (e.g., roof space for photovoltaic panels), mainstream availability of technology, regulatory constraints, and other practical considerations. In applying the quantification methods for these types of measures, it is important to evaluate the reasonableness and practicability of the assumptions regarding these parameters.

Over time, some of these limitations may change. Implementation costs decrease as advanced technology is reaches mass production scale, for example, technological innovation can address physical constraints, and regulations change. The determination of feasibility for project assumptions should therefore be reconsidered for future applications based on the best available information at the time.

Biogenic CO_2 Emissions: This document did not address biogenic CO_2 emissions. Biogenic CO_2 emissions result from materials that are derived from living cells, as opposed to CO_2 emissions derived from fossil fuels, limestone, and other materials that have been transformed by geological processes. Biogenic CO_2 contains carbon that is present in organic materials that include, but are not limited to, wood, paper, vegetable oils, animal fat, and waste from food, animals, and vegetation (such as yard or forest waste). Biogenic CO_2 emissions are excluded from these GHG emissions quantification methods because they are the result of materials in the biological/physical carbon cycle, rather than the geological carbon cycle.

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Introduction

The mitigation measures quantified for this Report fall into general categories within which the quantification methods follow a common approach. The following sections summarize the select categories and subcategories of measures and discuss the quantification methods used for each one. In general, emission reductions are quantified (1) as a percentage of the baseline emissions; or (2) by calculating mitigated emissions and determining the change in emissions relative to the baseline case. More detailed explanation of the parameters and equations used to calculate the emission reductions for each individual measure are provided in the Fact Sheets in Chapter 7.

Building Energy Use

The emissions associated with building energy use come from power generation that provides the energy used to operate the building. Power is typically generated by a remote, central electricity generating plant, or onsite generation by fuel combustion. These emissions can be reduced by lowering the amount of electricity and natural gas required for building operations. This can be achieved by designing a more energy-efficient building structure and/or installing energy-efficient appliances. Replacing high-emitting energy generation with clean energy will also reduce emissions, and that type of mitigation is discussed in "On-site Energy Generation" below.

NREL.gov

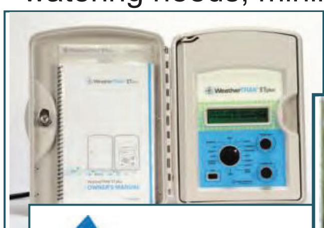
As discussed in Chapter 3, this Report does not include a lifecycle analysis for GHG emissions. However, if a project proposes mitigation in the form of improved building energy use, a limited analysis of indirect emissions will be needed to quantify the associated reductions in GHG emissions. Emissions associated with energy use to light and heat buildings are, as stated previously, well-defined and not considered to be "lifecycle emissions" for the purposes of this Report. The quantification methods in this Report that deal with building energy use provide a specific method for conducting that analysis.

Emission reductions in this category are quantified as percentage reductions in specific baseline energy end uses, such as Title 24-regulated energy or household appliance energy use. The baseline values are determined using California-specific energy end use databases such as California Commercial End-Use Survey (CEUS) and Residential Appliance Saturation Study (RASS). The percentage reduction in Title-24 regulated energy is a project-specific input, whereas the percentage reductions in energy use for energy-efficient models of various household appliances can be obtained from literature sources (for example, through the Energy Star program).

Outdoor Water Use

Energy use associated with pumping, treating and conveying water generates indirect GHG emissions. The amount of energy required depends on both the volume of water and energy intensity associated with the water source. For example, it generally takes less energy to pump and convey water from a local source than to transport water across long distances. As a result, the GHG emission factor associated with locally-sourced water will also be lower. Indirect GHG emissions associated with water use can be decreased by reducing the water demand and/or by using a less energy-intensive water source. As discussed in Chapter 3, these emissions are well-defined and are not considered to be “lifecycle emissions” for the purposes of this report.

Outdoor water use at mixed-use developments is associated with irrigation for landscaping. The volume of water required for landscaping will depend on the areal extent of landscaping; the specific watering needs for the type of vegetation; and the water efficiency of the irrigation system. A reduction in outdoor water demand can be achieved by designing water-efficient landscapes that include plants with relatively low watering needs; minimizing areas of water-intensive turf; and installing smart irrigation systems to avoid excessive water use. Emission reductions associated with water-efficient design are quantified as the difference between mitigated and baseline values, which in turn are estimated using established models from government agencies or scientific literature. Emission reductions associated with smart irrigation systems and turf minimization are quantified as percentage reductions from the baseline. The implementation of gray water systems, where allowed, and the use of recycled water can also reduce emissions; however, it is important to consider the energy used to operate the gray water or water recycling system. These percentages are either taken from literature or estimated using site-specific data. The quantification methods in this Report include estimates of electricity use for recycled water systems, but not for gray water systems, because those emissions are generally more site specific.



As described previously, the energy use intensity for water supply will depend on the water source and its associated treatment and conveyance requirements. The typical or baseline scenario water source for Southern California is the State Water Project; however, other less-energy intensive supplies such as locally-treated recycled wastewater may instead be used to satisfy some of the project’s non-potable water demand. Energy intensity values for different water sources can be obtained from California Energy Commission reports on water-related energy use, and are provided in Appendix E (Table E-2). Emissions associated with water use are estimated by multiplying the volume of water by the energy intensity value for the water source. The associated emission reduction is quantified by calculating emissions associated with water supplied by the lower impact water source (which can include the gray water or recycled water systems mentioned above), and subtracting it from the emissions associated with the same volume of water using the typical or baseline scenario water source.

Indoor Water Use

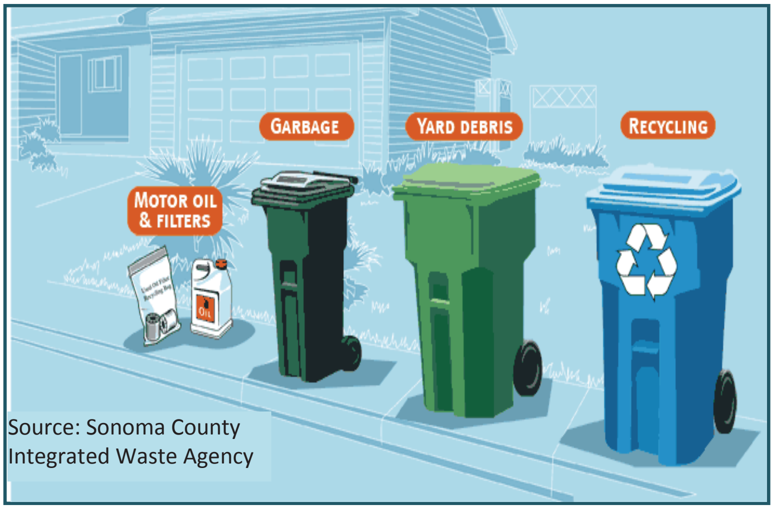
Similar to outdoor water use, indirect GHG emissions from indoor water use can be reduced by decreasing water demand or using a less energy-intensive water source. A project can reduce its indoor water demand relative to the baseline scenario by installing low-flow and high-efficiency water fixtures and appliances such as toilets, showerheads, faucets, clothes washers, and dishwashers.

Emission reductions associated with reduced water demand will be directly proportional to the decrease in demand. The total percentage reduction can be estimated by summing the reductions associated with each type of water-saving feature, which can be obtained from such sources as the California Green Building Standards Code or Energy Star standards. This total percentage would then be multiplied by the project's baseline demand, which should be available from the project's water assessment report. If the water assessment also has an estimate of mitigated water demand, which incorporates the reductions associated with water-saving features, then the reduction can be directly calculated as the difference between baseline and mitigated values.

Emission reductions associated with lower-impact water sources can be quantified as described above for outdoor water use.

Municipal Solid Waste

Solid waste generated at a site can directly produce GHG emissions via decomposition or incineration; it also generates vehicle-based emissions from trucks required to transport waste from its source to the waste handling facility. A reduction in the mass of municipal solid waste sent to landfills would lower emissions associated with its transport and treatment. This can be achieved by reducing the rate at which waste is generated, or by diverting material away from the landfill via on-site composting, reuse, or recycling operations (although direct and transport-related emissions associated with the alternate fates must be accounted for too).



Source: Sonoma County Integrated Waste Agency

Most methods to quantify municipal solid waste involve life-cycle assessments. The fact sheets describe the inventory emissions and the available tools that should be used if the Local Agency or project Applicant would like to quantify the benefits of a solid waste measure with respect to a reduction in life-cycle emissions.

Public Area and Traffic Signal Lighting

Energy use for lighting generates indirect GHG emissions. The amount of energy required for lighting depends in part on the number and energy needs of the lamps. Indirect emissions from lighting energy use can be reduced by installing energy-efficient lamps that maintain the same efficacy beyond what is required to meet any government standards. The replacement of existing, incandescent traffic signal lamps with light-emitting diode (LED) versions will reduce traffic light energy use relative to the baseline. New public lighting fixtures outfitted with energy-efficiency lamps will also use less electricity than the existing baseline energy use. However, because regulations require all new traffic lights to be LED-based, the methods in this Report do not quantify a reduction associated with LED traffic lights for new traffic intersections. Emissions reductions for lighting-based mitigation measures are quantified as percentages of the baseline emissions. The percentage reductions for energy-efficiency lighting are based on a survey of literature data.

Vegetation (including Trees)

As discussed in Chapter 3, vegetation incorporates carbon into its structure during its growth phase, and thereby can remove a finite amount of carbon from the atmosphere. The sequestration capacity of on-site vegetation is determined by the area available for vegetation, and the types of vegetation installed. A project can increase the area available for vegetation by converting previously developed land into vegetated open space. Conversions from one type of vegetated land to another may increase or decrease carbon sequestration, depending on the relative sequestration capacities of the land types. A third way to increase sequestration is by planting new trees on either developed or undeveloped land.

The increase in carbon sequestration capacity is determined by calculating the total sequestration capacity of converted land, new vegetated land and trees; and then subtracting the combined capacity of vegetated land or trees that are removed. Carbon sequestration capacities for different land types (e.g. cropland, forest land) and for different tree species classes are available from IPCC guidelines, and summarized in Table E-2, in Appendix E.

Construction Equipment

Construction equipment typically uses diesel fuel and releases emissions based on the amount of fuel combusted and emission factor of the equipment. Emissions can be reduced by using equipment that emits fewer pollutants for the same amount of work.

This is typically equipment powered through grid electricity or hybrid technology. The exclusive use of grid electricity eliminates the diesel emissions at the site but would increase indirect electricity emissions. However, grid-based emissions are typically small compared to the emissions from the diesel-fueled equipment (depending on the source of grid power). Hybrid-powered equipment would decrease but not completely eliminate fuel use. The electricity for hybrid equipment is self-generated unless the equipment has plug-in capability, so it would not increase grid-based electrical generation and the associated emissions there.

The emissions reductions in this category are determined by finding the difference between the estimated mitigation emissions and the baseline emissions for construction equipment. Emissions for the mitigated scenario may consist of direct emissions from combustion fuel use, and/or indirect emissions from grid electricity. These would be calculated using resources described previously, such as the OFFROAD database and literature-based methodologies and values.

Transportation

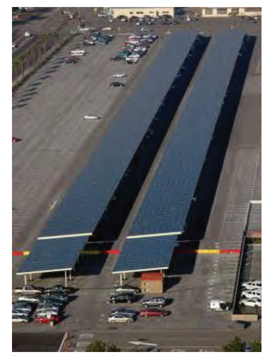
Transportation emissions can be reduced by improving the emissions profile of the vehicle fleet that travels the roads, or by reducing the vehicle miles traveled by the fleet. The majority of the measures quantified for this report focus on the reduction of VMT. This can be accomplished by optimizing the location and types of land uses in the project and its immediate vicinity, and by site enhancements to roads, and to bike and pedestrian networks to encourage the use of alternative modes of transportation. Mode shifts are also encouraged by implementing parking policies, transit system improvements, and trip reduction coordination or incentive programs.

The emission reductions in this category are determined by evaluating the elasticity of a measure relative to the amount of vehicle miles traveled that may be reduced as a result of the mitigation measure.

A few transportation measures in this Report are aimed at improving the emissions profile of the vehicle fleet. These measures promote alternative fuel, hybrid or electrical vehicles. The emission reductions in these measures are based on the improved emission factors and on changes to the assumed vehicle fleet mix.

On-Site Energy Generation

Different modes of energy generation have different GHG emission intensities. Fossil fuel-based generation emits GHG gases from combustion of the fuel, with the amount of emissions depending on the quantity and type of fuel used. Renewable energy generation, on the other hand, typically has significantly fewer emissions, and some types do not have any associated GHG emissions, such as photovoltaic systems and solar hot water heaters (excluding lifecycle emissions, as previously described in Chapter 3).


Solar Array at Coronado Naval Base

The emission reductions associated with using renewable non-emitting energy generated on-site are quantified as the emissions avoided because an equivalent amount of grid energy is not used. To calculate this, the energy generated by the on-site system(s) must be quantified, and then multiplied by the utility-specific emission factor for the type of energy (e.g. electricity, natural gas) being replaced. Energy generated on site is usually used for building operations; hence, it is generally considered a mitigation measure for building energy use.

Miscellaneous

The following miscellaneous mitigation measures are also discussed:

Loading Docks: A project applicant may elect to limit idling of engines beyond what is required by regulation at loading docks, or provide electrified loading docks. Electrified loading docks reduce the need for diesel auxiliary engines to run in order to keep refrigerated transportation units temperature controlled. The emission reduction is a comparison of the GHG emissions associated with the electricity compared to the diesel fuel combustion.

Off-site Mitigation: At the discretion of the reviewing agency, emission reductions may be created with offsite mitigation projects, as described in Chapter 2. If an off-site mitigation project is approved, the amount of emission reductions generated depends on the type of project implemented.

The numerical emission reductions would be quantified using the methods described for the different project categories above, with baseline values derived for the off-site location (instead of the project's baseline scenario). Once the numerical reductions have been estimated, they can be compared to the project's baseline emissions in order to determine the relative percentage reductions. Certain types of off-site projects may result in one-time emissions and others may result in a continuing stream of emissions reductions.

Carbon Sequestration: Emission reductions may be generated by implementing a carbon sequestration project. Carbon sequestration may be biological, chemical, or physical in nature, as described in Chapter 3. This Report does not address chemical or physical sequestration projects.

For biological sequestration, emission reductions are calculated as for vegetation projects (see above). The amount of the sequestration equals the amount of carbon removed by the vegetation.

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This chapter of the Report explains how the quantification of individual strategies is presented in Fact Sheets, how those fact sheets are designed and organized, and how to use them. This chapter also explains how and why mitigation measures have been grouped, and provides detailed discussion of how to apply the quantification methods when more than one strategy is being applied to the same project. A summary of the range of effectiveness for different measures is also provided for general information purposes, in table form, however it is very important that those generalized ranges NOT be used in place of the more specific quantification methods for the measure as detailed in the measure Fact Sheet. Finally, at the end of the Chapter there are step-by-step instructions on using the Fact Sheets, including an example.

Mitigation Strategies and Fact Sheets:

Accurate and reliable quantification depends on properly identifying the important variables that affect the emissions from an activity or source, and from changes to that activity or source. In order to provide a clear summary of those variables and usable instructions on how to find and apply the data needed, we have designed a Fact Sheet format to present each strategy or measure.

Types of Mitigation Strategies: There are three different types of mitigation strategies described in Chapter 7: Quantified measures, Best Management Practices, and General Plan strategies.

<u>Quantified Measures</u>: Quantified measures are fully quantified, project-level mitigation strategies. They are presented in categories where the nature of the underlying emissions sources are the same; the categories are discussed under “Organization of Fact Sheets” below. In addition, the measures may either stand alone, or be considered in connection with one or more other measures (that is, “grouped”). Groups of measures are always within a category; more detailed explanation is provided in “Grouping of Strategies” below. The majority of the strategies in this Report are fully Quantified Measures, and a strategy may be assumed to be of this type unless the Fact Sheet notes otherwise.

<u>Best Management Practices</u>: Several strategies are denoted as Best Management Practice (BMP). These measures are of two types. The first type of BMPs are quantifiable and describe methods that can be used to quantify the GHG mitigation reductions provided the project Applicant can provide substantial evidence supporting the values needed to quantify the reduction. These are listed as BMPs since there is not adequate literature at this time to generalize the mitigation measure reductions. However, the project Applicant may be able to provide the site specific information necessary to quantify a reduction. The second type of BMPs do not have methods for quantifying GHG mitigation reductions. These measures have preliminary evidence suggesting they will reduce GHG emissions if implemented, however, at this time adequate literature and methodologies are not available to quantify these reductions or

they involve life-cycle GHG emission benefits. The measures are encouraged to be implemented nonetheless. Local Agencies may decide to provide incentives to encourage implementation of these measures.

General Plan Strategies: The measures listed under the General Plan category are measures that will have the most benefit when implemented at a General Plan level, but are not quantifiable or applicable at the project specific level. While on a project basis some of these measures may not be quantifiable, at the General Plan level they may be quantified under the assumption that this will be implemented on a widespread basis. Local Agencies may decide to provide incentives or allocate the General Plan level reductions to specific projects by weighting the overall effect by the number of projects the General Plan reduction would apply to.

Introduction to the Fact Sheets: This Report presents the quantification of each mitigation measure in a Fact Sheet format. Each Fact Sheet includes: a detailed summary of each measure's applicability; the calculation inputs for the specific project; the baseline emissions method; the mitigation calculation method and associated assumptions; a discussion of the calculation and an example calculation; and finally a summary of the preferred and alternative literature sources for measure efficacy. The Fact Sheets are found in Chapter 7.

Layout of the Fact Sheets: Each Fact Sheet describes one mitigation measure. The mitigation measure has a unique number and is provided at the bottom of each page in that measure's Fact Sheet. This will assist the end user in determining where a mitigation measure fact sheet begins and ends while still preserving consecutive page numbers in the overall Report.

At the top of each Fact Sheet, the name of the measure category appears on the left, and the subcategory on the right. Cross-references to prior CAPCOA documents appear at the top left, below the category name. Specifically, measures labeled CEQA #: are from the *CAPCOA 2008 CEQA & Climate Change*[1] and measures labeled MP#: are from the *CAPCOA 2009 Model Policies for Greenhouse Gases in General Plans*[2]. This cross-referencing is also included in the list of measures at the beginning of Chapter 7, and is intended to allow the user to move easily between the documents. The measure number is at the bottom of the page, on the right-hand side.

The fact sheets begin with a measure description. This description includes two critical components:

(1) Specific language regarding the measure implementation – which should be consistent with the implementation method suggested by the project Applicant; and

[1] Available online at http://www.capcoa.org/wp-content/uploads/downloads/2010/05/CAPCOA-White-Paper.pdf
[2] Available online at http://www.capcoa.org/wp-content/uploads/downloads/2010/05/CAPCOA-ModelPolicies-6-12-09-915am.pdf

(2) A discussion of key support strategies that are required for the reported range of effectiveness.

Appendices with additional calculations and assumptions for some of the fact sheets are provided at the end of this document. Default assumptions should be carefully reviewed for project applicability. Appendix B details the methodologies that should be used to calculate baseline GHG emissions for a project.

Organization of the Fact Sheets – Categories and Subcategories: The Fact Sheets are organized by general emission category types as follows:

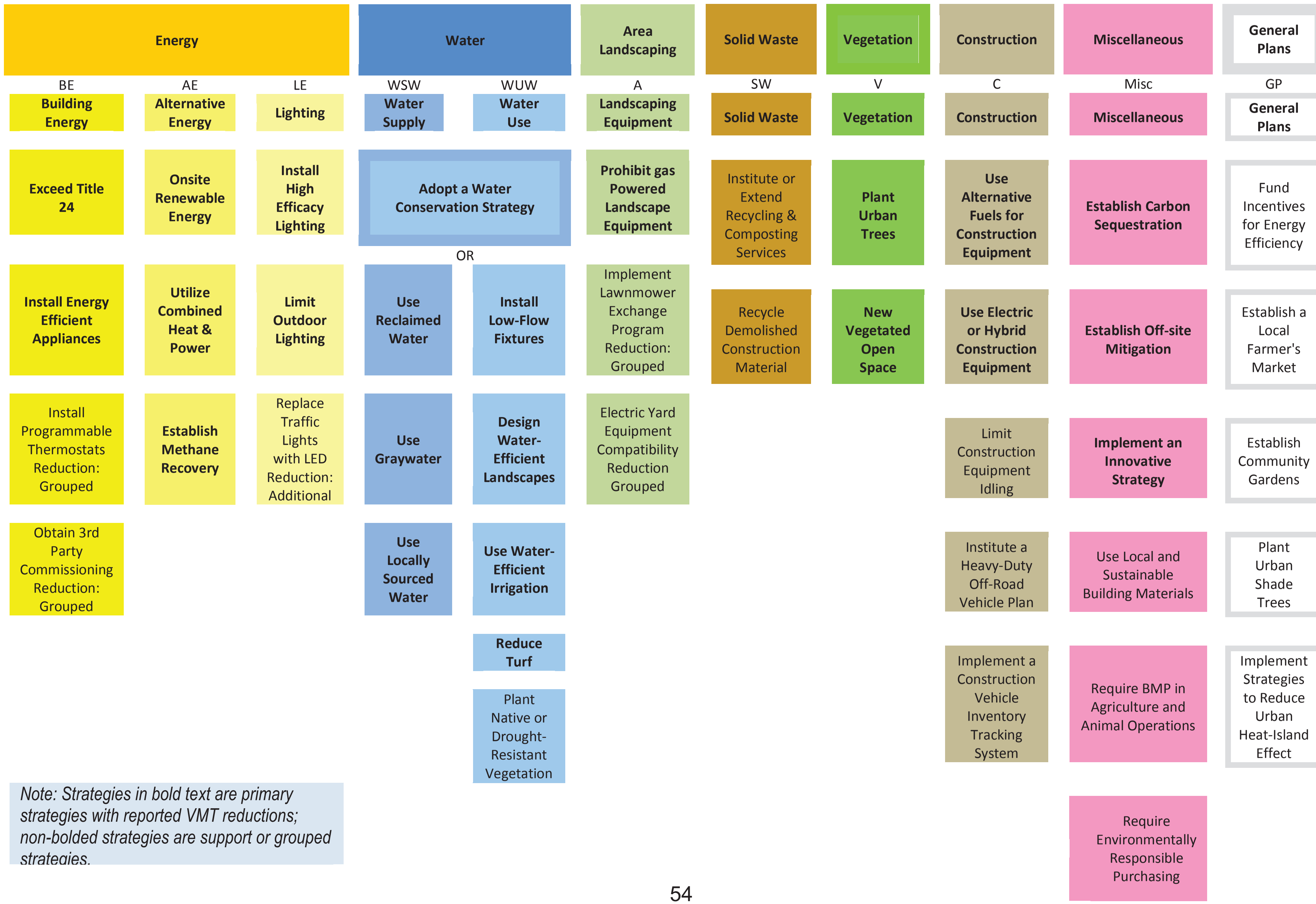
- Energy
- Transportation
- Water
- Landscape Equipment
- Solid Waste
- Vegetation
- Construction
- Miscellaneous Categories
- General Plans

Several of these main categories are split into subcategories, for ease of understanding how to properly address the effects of combining the measures. Strategies are organized into categories and subcategories where they affect similar types of emissions sources. As an example, the category of "Energy" includes measures that reduce emissions associated with energy generation and use. Within that category, there are subcategories of measures that address "Building Energy Use," "Alternative Energy," and "Lighting," each with one or more measures in it. The measures in the subcategory are closely related to each other.

Categories and subcategories for the measures are illustrated in Charts 6-1 and 6-2, below. Chart 6-1 shows all of the measure categories EXCEPT the Transportation category, including their subcategories; note that not all categories have subcategories. Measures in the Transportation category are shown in Chart 6-2. There are a number of subcategories associated with the Transportation category. As shown in Chart 6-2, the primary measures in each subcategory are indicated in bold type, and the measures shown in normal type are either support measures, or they are explicitly "grouped" measures.

It is important to note that subcategories are NOT the same as "grouped" measures / strategies. The grouping of strategies connotes a specific relationship, and is explained in the next section, below.

Chart 6-1: Non-Transportation Strategies Organization



Note: Strategies in bold text are primary strategies with reported VMT reductions; non-bolded strategies are support or grouped strategies.

Chart 6-2: Transportation Strategies Organization

Transportation Measures (Five Subcategories) Global Maximum Reduction (all VMT): urban = 75%; compact infill = 40%; suburban center or suburban with NEV = 20%; suburban = 15%

Global Cap for Road Pricing needs further study

Transportation Measures (Four Categories) Cross-Category Max Reduction (all VMT): urban = 70%; compact infill = 35%; suburban center or suburban with NEV = 15%; suburban = 10%

Land Use / Location	Neighborhood / Site Enhancement	Parking Policy / Pricing	Transit System Improvements	Commute Trip Reduction	Road Pricing Management	Vehicles
				Max Reduction = 15% overall; work VMT = 25%; school VMT = 65%;	Max Reduction = 25% (all VMT)	
Max Reduction: urban = 65%; compact infill = 30%; suburban center = 10%; suburban = 5%	Max Reduction: without NEV = 5%; with NEV = 15%	Max Reduction = 20%	Max Reduction = 10%	(assumes mixed use) Max Reduction = 25% (work VMT)	Max Reduction = 25%	
Density (30%)	Pedestrian Network (2%)	Parking Supply Limits (12.5%)	Network Expansion (8.2%)	CTR Program Required = 21% work VMT Voluntary = 6.2% work VMT	Cordon Pricing (22%)	Electrify Loading Docks
Design (21.3%)	Traffic Calming (1%)	Unbundled Parking Costs (13%)	Service Frequency / Speed (2.5%)	Transit Fare Subsidy (20% work VMT)	Traffic Flow Improvements (45% CO2)	Utilize Alternative Fueled Vehicles
Location Efficiency (65%)	NEV Network (14.4) <NEV Parking>	On-Street Market Pricing (5.5%)	Bus Rapid Transit (3.2%)	Employee Parking Cash-out (7.7% work VMT)	Required Contributions by Project	Utilize Electric or Hybrid Vehicles
Diversity (30%)	Car Share Program (0.7%)	Residential Area Parking Permits	Access Improvements	Workplace Parking Pricing (19.7% work VMT)		
Destination Accessibility (20%)	Bicycle Network <Lanes> <Parking> <Land Dedication for Trails>		Station Bike Parking	Alternative Work Schedules & Telecommute (5.5% work VMT)		
Transit Accessibility (25%)	Urban Non-Motorized Zones		Local Shuttles	CTR Marketing (5.5% work VMT)		
BMR Housing (1.2%)			Park & Ride Lots*	Employer-Sponsored Vanpool/Shuttle (13.4% work VMT)		
Orientation Toward Non-Auto Corridor				Ride Share Program (15% work VMT)		
Proximity to Bike Path				Bike Share Program		
				End of Trip Facilities		
				Preferential Parking Permit		
				School Pool (15.8% school VMT)		
				School Bus (6.3% school VMT)		

Note: Strategies in bold text are primary strategies with reported VMT reductions; non-bolded strategies are support or grouped strategies.

Grouping of Strategies

Strategies noted as "grouped" are separately documented in individual Fact Sheets but must be paired with other strategies within the category. When these "grouped" strategies are implemented together, the combination will result in either an enhancement to the primary strategy by improving its effectiveness or a non-negligible reduction in effectiveness that would not occur without the combination.

Rules for Combining Strategies or Measures

Mitigation measures or strategies are frequently implemented together with other measures. Often, combining measures can lead to better emission reductions than implementing a single measure by itself. Unfortunately, the effects of combining the measures are not always as straightforward as they might at first appear. When more and more measures are implemented to mitigate a particular source of emissions, the benefit of each additional measure diminishes. If it didn't, some odd results would occur. For example, if there were a series of measures that each, independently, was predicted to reduce emissions from a source by 10%, and if the effect of each measure was independent of the others, then implementing ten measures would reduce all of the emissions; and what would happen with the eleventh measure? Would the combination reduce 110% of the emissions? No. In fact, each successive measure is slightly less effective than predicted when implemented on its own.

On the other hand, some measures enhance the performance of a primary measure when they are combined. This Report includes a set of rules that govern different ways of combining measures. The rules depend on whether the measures are in the *same* category, or different categories. Remember, the categories include: Energy, Transportation, Water, Landscape Equipment, Solid Waste, Vegetation, Construction, Miscellaneous Categories, and General Plans.

Combinations <u>Between</u> Categories: The following procedures must be followed when combining mitigation measures that fall in separate categories. In order to determine the overall reduction in GHG emissions compared to the baseline emissions, the relative magnitude of emissions between the source categories needs to be considered. To do this, the user should determine the percent contribution made by each individual category to the overall baseline GHG emissions. This percent contribution by a category should be multiplied by the reduction percentages from mitigation measures in that category to determine the scaled GHG emission reductions from the measures in that category. This is done for each category to be combined. The scaled GHG emissions for each category can then be added together to give a total GHG reduction for the combined measures in all of the categories.

For example, consider a project whose total GHG emissions come from the following categories: transportation (50%), building energy use (40%), water (6%), and other (4%). This project implements a transportation mitigation measure that results in a 10% reduction in VMT. The project also implements mitigation measures that result in a 30% reduction in water usage. The overall reduction in GHG emissions is as follows:

Reduction from Transportation: 0.50 x 0.10 = 0.5 or 5%
Reduction from Water: 0.06 x 0.30 = 0.018 or 1.8%

Total Reduction: 5% + 1.8% = 6.8%

This example illustrates the importance of the magnitude of a source category and its influence on the overall GHG emission reductions.

The percent contributions from source categories will vary from project to project. In a commercial-only project it may not be unusual for transportation emissions to represent greater than 75% of all GHG emissions whereas for a residential or mixed use project, transportation emissions would be below 50%.

Combinations Within Categories: The following procedures must be followed when combining mitigation measures that fall within the same category.

Non-Transportation Combinations: When combining non-transportation subcategories, the total amount of reductions for that category should not exceed 100% except for categories that would result in additional excess capacity that can be used by others, but which the project wants to take credit for (subject to approval of the reviewing agency). This may include alternative energy generation systems tied into the grid, vegetation measures, and excess graywater or recycled water generated by the project and used by others. These excess emission reductions may be used to offset other categories of emissions, with approval of the agency reviewing the project. In these cases of excess capacity, the quantified amounts of excess emissions must be carefully verified to ensure that any credit allowed for these additional reductions is truly surplus.

Category Maximum- Each category has a maximum allowable reduction for the combination of measures in that category. It is intended to ensure that emissions are not double counted when measures within the category are combined. Effectiveness levels for multiple strategies within a subcategory (as denoted by a column in the appropriate chart, above) may be multiplied to determine a combined effectiveness level up to a maximum level. This should be done first to mitigation measures that are a source reduction followed by those that are a reduction to emission factors. Since the combination of mitigation measures and independence of mitigation measures are both complicated, this Report recommends that mitigation measure reductions within a category be multiplied unless a project applicant can provide substantial evidence indicating that emission reductions are independent of one another. This will take the following form:

GHG emission reduction for category = 1-[(1-A) x (1-B) x (1-C)]

Where:

A, B and C =   Individual mitigation measure reduction percentages for the strategies to be combined in a given category.

Global Maximum- A separate maximum, referred to as a global maximum level, is also provided for a combination across subcategories. Effectiveness levels for multiple strategies across categories may also be multiplied to determine a combined effectiveness level up to global maximum level.

For example, consider a project that is combining 3 mitigation strategies from the water category. This project will install low-flow fixtures (measure WUW-1), use water-efficient irrigation (measure WUW-4, and reduce turf (measure WUW-5). Reductions from these measures will be:

- low-flow fixtures 20% or 0.20 (A)
- water efficient irrigation 10% or 0.10 (B)
- turf reductions 20% or 0.20 (C)

To combine measures within a category, the reductions would be
= 1-[(1-A) x (1-B) x (1-C)]
= 1-[(1-.20) x (1-.10) x (1-.20)]
= 1-[(0.8) x (0.9) x (.8)]
= 1-0.576 = 0.424
= 42.4%

Transportation Combinations: The interactions between the various categories of transportation-related mitigation measures is complex and sometimes counter-intuitive. Combining these measures can have a substantive impact on the quantification of the associated emission reductions. In order to safeguard the accuracy and reliability of the methods, while maintaining their ease of use, the following rules have been developed and should be followed when combining transportation-related mitigation measures. The rules are presented by sub-category, and reference Chart 6-2 Transportation Strategies Organization. The maximum reduction values also reflect the highest reduction levels justified by the literature. The chart indicates maximum reductions for individual mitigation measures just below the measure name.

Cross-Category Maximum- A cross-category maximum is provided for any combination of land use, neighborhood enhancements, parking, and transit strategies (columns A-D in Chart 6-1, with the maximum shown in the top row). The total project VMT reduction across these categories should be capped at these levels based on empirical evidence.[3] Caps are provided for the location/development type of the project. VMT reductions may be multiplied across the four categories up to this maximum. These include:

- Urban: 70% VMT
- Compact Infill: 35%
- Suburban Center (or Suburban with NEV): 15%
- Suburban: 10% (note that projects with this level of reduction must include a diverse land use mix, workforce housing, and project-specific transit; limited empirical evidence is available)

(See blue box, pp. 58-59.)

[3] As reported by Holtzclaw, et al for the State of California.

As used in this Report, location settings are defined as follows:

Urban: A project located within the central city and may be characterized by multi-family housing, located near office and retail. Downtown Oakland and the Nob Hill neighborhood in San Francisco are examples of the typical urban area represented in this category. The urban maximum reduction is derived from the average of the percentage difference in per capita VMT versus the California statewide average (assumed analogous to an ITE baseline) for the following locations:

Location	Percent Reduction from Statewide VMT/Capita
Central Berkeley	-48%
San Francisco	-49%
Pacific Heights (SF)	-79%
North Beach (SF)	-82%
Mission District (SF)	-75%
Nob Hill (SF)	-63%
Downtown Oakland	-61%

The average reflects a range of 48% less VMT/capita (Central Berkeley) to 82% less VMT/capita (North Beach, San Francisco) compared to the statewide average. The urban locations listed above have the following characteristics:

- Location relative to the regional core: these locations are within the CBD or less than five miles from the CBD (downtown Oakland and downtown San Francisco).
- Ratio or relationship between jobs and housing: jobs-rich (jobs/housing ratio greater than 1.5)
- Density character
  - typical building heights in stories: six stories or (much) higher
  - typical street pattern: grid
  - typical setbacks: minimal
  - parking supply: constrained on and off street
  - parking prices: high to the highest in the region
- Transit availability: high quality rail service and/or comprehensive bus service at 10 minute headways or less in peak hours

Compact infill: A project located on an existing site within the central city or inner-ring suburb with high-frequency transit service. Examples may be community redevelopment areas, reusing abandoned sites, intensification of land use at established transit stations, or converting underutilized or older industrial buildings. Albany and the Fairfax area of Los Angeles are examples of typical compact infill area as used here. The compact infill maximum reduction is derived from the average of the percentage difference in per capita VMT versus the California statewide average for the following locations:

Location	Percent Reduction from Statewide VMT/Capita
Franklin Park, Hollywood	-22%
Albany	-25%
Fairfax Area, Los Angeles	-29%
Hayward	-42%

The average reflects a range of 22% less VMT/capita (Franklin Park, Hollywood) to 42% less VMT/capita (Hayward) compared to the statewide average. The compact infill locations listed above have the following characteristics:

- Location relative to the regional core: these locations are typically 5 to 15 miles outside a regional CBD
- Ratio or relationship between jobs and housing: balanced (jobs/housing ratio ranging from 0.9 to 1.2)
- Density character
  - typical building heights in stories: two to four stories
  - typical street pattern: grid
  - typical setbacks: 0 to 20 feet
  - parking supply: constrained
  - parking prices: low to moderate
- Transit availability: rail service within two miles, or bus service at 15 minute peak headways or less

As used in this Report, additional location settings are defined as follows:

Suburban Center: A project typically involving a cluster of multi-use development within dispersed, low-density, automobile dependent land use patterns (a suburb). The center may be an historic downtown of a smaller community that has become surrounded by its region's suburban growth pattern in the latter half of the 20th Century. The suburban center serves the population of the suburb with office, retail and housing which is denser than the surrounding suburb. The suburban center maximum reduction is derived from the average of the percentage difference in per capita VMT versus the California statewide average for the following locations:

Location	Percent Reduction from Statewide VMT/Capita
Sebastopol	0%
San Rafael (Downtown)	-10%
San Mateo	-17%

The average reflects a range of 0% less VMT/capita (Sebastopol) to 17% less VMT/capita (San Mateo) compared to the statewide average. The suburban center locations listed above have the following characteristics:

- Location relative to the regional core: these locations are typically 20 miles or more from a regional CBD
- Ratio or relationship between jobs and housing: balanced
- Density character
  - typical building heights in stories: two stories
  - typical street pattern: grid
  - typical setbacks: 0 to 20 feet
  - parking supply: somewhat constrained on street; typically ample off-street
  - parking prices: low (if priced at all)
- Transit availability: bus service at 20-30 minute headways and/or a commuter rail station

While all three locations in this category reflect a suburban "downtown," San Mateo is served by regional rail (Caltrain) and the other locations are served by bus transit only. Sebastopol is located more than 50 miles from downtown San Francisco, the nearest urban center. San Rafael and San Mateo are located 20 miles from downtown San Francisco.

Suburban: A project characterized by dispersed, low-density, single-use, automobile dependent land use patterns, usually outside of the central city (a suburb). Suburbs typically have the following characteristics:

- Location relative to the regional core: these locations are typically 20 miles or more from a regional CBD
- Ratio or relationship between jobs and housing: jobs poor
- Density character
  - typical building heights in stories: one to two stories
  - typical street pattern: curvilinear (cul-de-sac based)
  - typical setbacks: parking is generally placed between the street and office or retail buildings; large-lot residential is common
  - parking supply: ample, largely surface lot-based
  - parking prices: none
- Transit availability: limited bus service, with peak headways 30 minutes or more

The maximum reduction provided for this category assumes that regardless of the measures implemented, the project's distance from transit, density, design, and lack of mixed use destinations will keep the effect of any strategies to a minimum.

Global Maximum- A global maximum is provided for any combination of land use, neighborhood enhancements, parking, transit, and commute trip reduction strategies (the first five columns in the organization chart). This excludes reductions from road-pricing measurements which are discussed separately below. The total project VMT reduction across these categories, which can be combined through multiplication, should be capped at these levels based on empirical evidence.[4] Maximums are provided for the location/development type of the project. The Global Maximum values can be found in the top row of Chart 6-2.

These include:

- Urban: 75% VMT
- Compact Infill: 40% VMT
- Suburban Center (or Suburban with NEV): 20%
- Suburban: 15% (limited empirical evidence available)

Specific Rules for Subcategories within Transportation- Because of the unique interactions of measures within the Transportation Category, each subcategory has additional rules or criteria for combining measures.

❖ Land Use/Location Strategies – Maximum Reduction Factors: Land use measures apply to a project area with a radius of ½ mile. If the project area under review is greater than this, the study area should be divided into subareas of radii of ½ mile, with subarea boundaries determined by natural "clusters" of integrated land uses within a common walkshed. If the project study area is smaller than ½ mile in radius, other land uses within a ½ mile radius of the key destination point in the study area (i.e. train station or employment center) should be included in design, density, and diversity calculations. Land use measures are capped based on empirical evidence for location setting types as follows:[5]

  - Urban: 65% VMT
  - Compact Infill: 30% VMT
  - Suburban Center: 10% VMT
  - Suburban: 5% VMT

❖ Neighborhood/Site Enhancements Strategies – Maximum Reduction Factors: The neighborhood/site enhancements category is capped at 12.7% VMT reduction (with Neighborhood Electric Vehicles (NEVs)) and 5% without NEVs based on empirical evidence (for NEVs) and the multiplied combination of the non-NEV measures.

❖ Parking Strategies – Maximum Reduction Factors: Parking strategies should be implemented in one of two combinations:

  - Limited (reduced) off-street supply ratios plus residential permit parking and priced on-street parking (to limit spillover), or
  - Unbundled parking plus residential permit parking and priced on-street parking (to limit spillover).

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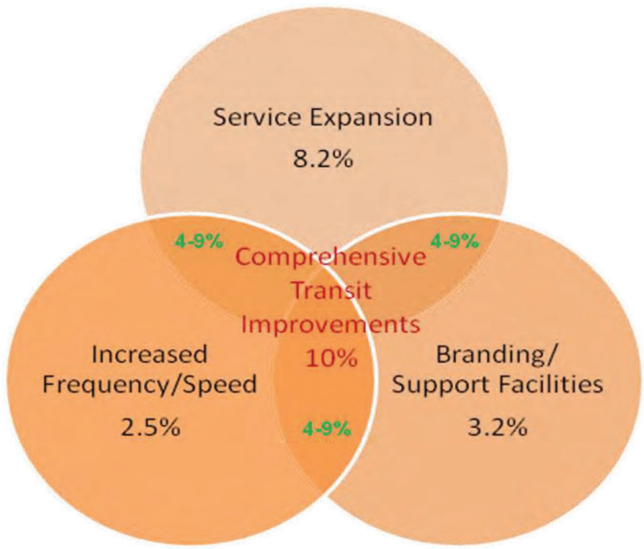
[4] As reported by Holtzclaw, et al for the State of California. Note that CTR strategies must be converted to overall VMT reductions (from work-trip VMT reductions) before being combined with strategies in other categories.

[5] As reported for California locations in Holtzclaw, et al. "Location Efficiency: Neighborhood and Socioeconomic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles, and San Francisco." *Transportation Planning and Technol*ogy, 2002, Vol. 25, pp. 1–27.

Note: The reduction maximum of 20% VMT reflects the combined (multiplied) effect of unbundled parking and priced on-street parking.

- Transit System Strategies – Maximum Reduction Factors: The 10% VMT reduction maximum for transit system improvements reflects the combined (multiplied) effect of network expansion and service frequency/speed enhancements. A comprehensive transit improvement would receive this type of reduction, as shown in the center overlap in the Venn diagram, below.



- Commuter Trip Reductions (CTR) Strategies – Maximum Reduction Factors: The most effective commute trip reduction measures combine incentives, disincentives, and mandatory monitoring, often through a transportation demand management (TDM) ordinance. Incentives encourage a particular action, for example parking cash-out, where the employee receives a monetary incentive for not driving to work, but is not punished for maintaining status quo. Disincentives establish a penalty for a status quo action. An example is workplace parking pricing, where the employee is now monetarily penalized for driving to work. The 25% maximum for work-related VMT applies to comprehensive CTR programs. TDM strategies that include only incentives, only disincentives, and/or no mandatory monitoring, should have a lower total VMT reduction than those with a comprehensive approach. Support strategies to strengthen CTR programs include guaranteed-ride-home, taxi vouchers, and message boards/marketing materials. A 25% reduction in work-related VMT is assumed equivalent to a 15% reduction in overall project VMT for the purpose of the global maximum; this can be adjusted for project-specific land use mixes.

  Two school-related VMT reduction measures are also provided in this category. The maximum reduction for these measures should be 65% of school-related VMT based on the literature.

- Road Pricing/Management Strategies – Maximum Reduction Factors: Cordon pricing is the only strategy in this category with an expected VMT reduction potential. Other forms of road pricing would be applied at a corridor or region-wide level rather than as mitigation applied to an individual development project. No domestic case studies are available for cordon pricing, but international studies suggest a VMT reduction maximum of 25%. A separate, detailed, and project-specific study should be conducted for any project where road pricing is proposed as a VMT reduction measure.

Additional Rules for Transportation Measures- There are also restrictions on the application of measures in rural applications, and application to baseline, as follows:

- Rural Application: Few empirical studies are available to suggest appropriate VMT reduction caps for strategies implemented in rural areas. Strategies likely to have the largest VMT reduction in rural areas include vanpools, telecommute or alternative work schedules, and master planned communities (with design and land use diversity to encourage intra-community travel). NEV networks may also be appropriate for larger scale developments. Because of the limited empirical data in the rural context, project-specific VMT reduction estimates should be calculated.

- Baseline Application: As discussed in previous sections of this report, VMT reductions should be applied to a baseline VMT expected for the project, based on the Institute of Transportation Engineers' 8th Edition *Trip Generation Manual* and associated typical trip distance for each land use type. Where trip generation rates and project VMT provided by the project Applicant are derived from another source, the VMT reductions must be adjusted to reflect any "discounts" already applied.

Range of Effectiveness of Mitigation Measures

The following charts provide the range of effectiveness for the quantified mitigation measures. Each chart shows one category of measures, with subcategories identified. The charts also show the basis for the quantification, and indicate applicable groupings. IMPORTANT: these ranges are approximate and should NOT be used in lieu of the specific quantification method provided in the fact sheet for each measure. Restrictions on combining measures must be observed.

CAPCOA

Table 6-1: Energy Category

Energy						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Building Energy Use	BE-1	Buildings exceed Title 24 Building Envelope Energy Efficiency Standards by X% (X is equal to the percentage improvement selected for the project			For a 10% improvement over 2008 Title 24: Non-Residential electricity use: 0.2-5.5%; natural gas use: 0.7-10% Residential electricity use: 0.3-2.6%; natural gas use: 7.5-9.1%	
	BE-2	Install Programmable Thermostat Timers	x		BMP	
	BE-3	Obtain Third-party HVAC Commissioning and Verification of Energy Savings	x	BE-1	BMP	
	BE-4	Install Energy Efficient Appliances			Residential building: 2-4% Grocery Stores: 17-22%	Appliance Electricity Use
	BE-5	Install Energy Efficient Boilers			1.2-18.4%	Fuel Use
Alternative Energy Generation	AE-1	Establish Onsite Renewable Energy Systems-Generic			0-100%	
	AE-2	Establish Onsite Renewable Energy Systems-Solar Power			0-100%	
	AE-3	Establish Onsite Renewable Energy Systems-Wind Power			0-100%	
	AE-4	Utilize a Combined Heat and Power System			0-46%	
	AE-5	Establish Methane Recovery in Landfills			73-77%	
	AE-6	Establish Methane Recovery in Wastewater Treatment Plants			95-97%	
Lighting	LE-1	Install Higher Efficacy Public Street and Area Lighting			16-40%	Outdoor Lighting Electricity Use
	LE-2	Limit Outdoor Lighting Requirements	x		BMP	
	LE-3	Replace Traffic Lights with LED Traffic Lights			90%	Traffic Light Electricity Use

Table 6-2: Transportation Category

Transportation						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Land Use / Location	LUT-1	Increase Density			1.5-30.0%	VMT
	LUT-2	Increase Location Efficiency			10-65%	VMT
	LUT-3	Increase Diversity of Urban and Suburban Developments (Mixed Use)			9-30%	VMT
	LUT-4	Incr. Destination Accessibility			6.7-20%	VMT
	LUT-5	Increase Transit Accessibility			0.5-24.6%	VMT
	LUT-6	Integrate Affordable and Below Market Rate Housing			0.04-1.20%	VMT
	LUT-7	Orient Project Toward Non-Auto Corridor			NA	
	LUT-8	Locate Project near Bike Path/Bike Lane			NA	
	LUT-9	Improve Design of Development			3.0-21.3%	VMT
Neighborhood / Site Design	SDT-1	Provide Pedestrian Network Improvements			0-2%	VMT
	SDT-2	Traffic Calming Measures			0.25-1.00%	VMT
	SDT-3	Implement a Neighborhood Electric Vehicle (NEV) Network			0.5-12.7%	VMT
	SDT-4	Urban Non-Motorized Zones		SDT-1	NA	
	SDT-5	Incorporate Bike Lane Street Design (on-site)		LUT-9	NA	
	SDT-6	Provide Bike Parking in Non-Residential Projects		LUT-9	NA	
	SDT-7	Provide Bike Parking in Multi-Unit Residential Projects		LUT-9	NA	
	SDT-8	Provide EV Parking		SDT-3	NA	
	SDT-9	Dedicate Land for Bike Trails		LUT-9	NA	
Parking Policy / Pricing	PDT-1	Limit Parking Supply			5-12.5%	
	PDT-2	Unbundle Parking Costs from Property Cost			2.6-13%	
	PDT-3	Implement Market Price Public Parking (On-Street)			2.8-5.5%	
	PDT-4	Require Residential Area Parking Permits		PDT-1, 2 & 3	NA	

Transportation - continued						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Trip Reduction Programs	TRT-1	Implement Voluntary CTR Programs			1.0-6.2%	Commute VMT
	TRT-2	Implement Mandatory CTR Programs – Required Implementation/Monitoring			4.2-21.0%	Commute VMT
	TRT-3	Provide Ride-Sharing Programs			1-15%	Commute VMT
	TRT-4	Implement Subsidized or Discounted Transit Prog.			0.3-20.0%	Commute VMT
	TRT-5	Provide End of Trip Facilities		TRT-1, 2 & 3	NA	
	TRT-6	Telecommuting and Alternative Work Schedules			0.07-5.50%	Commute VMT
	TRT-7	Implement Commute Trip Reduction Marketing			0.8-4.0%	Commute VMT
	TRT-8	Implement Preferential Parking Permit Program		TRT-1, 2 & 3	NA	
	TRT-9	Implement Car-Sharing Program			0.4-0.7%	VMT
	TRT-10	Implement School Pool Program			7.2-15.8%	School VMT
	TRT-11	Provide Employer-Sponsored Vanpool/Shuttle			0.3-13.4%	Commute VMT
	TRT-12	Implement Bike-Sharing Program		SDT-5, LUT-9	NA	
	TRT-13	Implement School Bus Program			38-63%	School VMT
	TRT-14	Price Workplace Parking			0.1-19.7%	Commute VMT
	TRT-15	Implement Employee Parking "Cash-Out"			0.6-7.7%	Commute VMT

Transportation - continued						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Transit System Improvements	TST-1	Provide a Bus Rapid Transit System			0.02-3.2%	VMT
	TST-2	Implement Transit Access Improvements		TST-3, TST-4	NA	
	TST-3	Expand Transit Network			0.1-8.2%	VMT
	TST-4	Increase Transit Service Frequency/Speed			0.02-2.5%	VMT
	TST-5	Provide Bike Parking Near Transit		TST-3, TST-4	NA	
	TST-6	Provide Local Shuttles		TST-3, TST-4	NA	
Road Pricing / Management	RPT-1	Implement Area or Cordon Pricing			7.9-22.0%	VMT
	RPT-2	Improve Traffic Flow			0-45%	VMT
	RPT-3	Require Project Contributions to Transportation Infrastructure Improvement Projects		RPT-2, TST-1 to 6	NA	
	RPT-4	Install Park-and-Ride Lots		RPT-1, TRT-11, TRT-3, TST-1 to 6	NA	
Vehicles	VT-1	Electrify Loading Docks and/or Require Idling-Reduction Systems			26-71%	Truck Idling Time
	VT-2	Utilize Alternative Fueled Vehicles			Varies	
	VT-3	Utilize Electric or Hybrid Vehicles			0.4-20.3%	Fuel Use

Table 6-3: Water Category

Water						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Water Supply	WSW-1	Use Reclaimed Water			up to 40% for Northern Californiaup to 81% for Southern California	Outdoor Water Use
	WSW-2	Use Gray Water			0-100%	Outdoor Water Use
	WSW-3	Use Locally-Sourced Water Supply			0-60% for Northern and Central California; 11-75% for Southern California	Indoor and Outdoor Water Use
Water Use	WUW-1	Install Low-Flow Water Fixtures.			Residential: 20% Non-Residential: 17-31%	Indoor Water Use
	WUW-2	Adopt a Water Conservation Strategy.			varies	
	WUW-3	Design Water-Efficient Landscapes			0-70%	Outdoor Water Use
	WUW-4	Use Water-Efficient Landscape Irrigation Systems			6.1%	Outdoor Water Use
	WUW-5	Reduce Turf in Landscapes and Lawns			varies	
	WUW-6	Plant Native or Drought-Resistant Trees and Vegetation			BMP	

Table 6-4: Area Landscaping

Area Landscaping						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Area Landscaping	A-1	Prohibit Gas Powered Landscape Equipment.			LADWP: 2.5-46.5% PG&E: 64.1-80.3% SCE: 49.5-72.0% SDGE: 38.5-66.3% SMUD: 56.3-76.0%	Fuel Use
	A-2	Implement Lawnmower Exchange Program			BMP	
	A-3	Electric Yard Equipment Compatibility		A-1 or A-2	BMP	

Table 6-5: Solid Waste Category

Solid Waste						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Solid Waste	SW-1	Institute or Extend Recycling and Composting Services			BMP	
	SW-2	Recycle Demolished Construction Material			BMP	

Table 6-6: Vegetation Category

Vegetation						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Vegetation	V-1	Urban Tree Planting		GP-4	varies	
	V-2	Create new vegetated open space.			varies	

Table 6-7: Construction Category

Construction						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Construction	C-1	Use Alternative Fuels for Construction Equipment			0-22%	Fuel Use
	C-2	Use Electric and Hybrid Construction Equipment			2.5-80%	Fuel Use
	C-3	Limit Construction Equipment Idling beyond Regulation Requirements			varies	
	C-4	Institute a Heavy-Duty Off-Road Vehicle Plan		Any C	BMP	
	C-5	Implement a Vehicle Inventory Tracking System		Any C	BMP	

Table 6-8: Miscellaneous Category

Miscellaneous						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
Miscellaneous	Misc-1	Establish a Carbon Sequestration Project			varies	
	Misc-2	Establish Off-Site Mitigation			varies	
	Misc-3	Use Local and Sustainable Building Materials	x		BMP	
	Misc-4	Require Best Management Practices in Agriculture and Animal Operations	x		BMP	
	Misc-5	Require Environmentally Responsible Purchasing	x		BMP	
	Misc-6	Implement an Innovative Strategy for GHG Mitigation	x		BMP	

Table 6-9: General Plans

General Plan Strategies						
Category	Measure Number	Strategy	BMP	Grouped With #	Range of Effectiveness	
					Percent Reduction in GHG Emissions	Basis
General Plans	GP-1	Fund Incentives for Energy Efficiency	x		BMP	
	GP-2	Establish a Local Farmer's Market	x		BMP	
	GP-3	Establish Community Gardens	x		BMP	
	GP-4	Plant Urban Shade Trees	x	V-1	BMP	
	GP-5	Implement Strategies to Reduce Urban Heat-Island Effect	x		BMP	

Applicability of Quantification Fact Sheets Outside of California
In order to apply the quantification methods in this Report to projects located outside of California, the assumptions and methods in the baseline methodology and in the Fact Sheets should be reviewed prior to applying them. First, evaluate the basis for use metrics and emission factors for applicability outside of California. The Report references various sources for use metrics and emission factors; if these are California-specific, the method should be evaluated to determine if these same use metrics and emission factors are applicable to the project area. If they are not applicable, factors appropriate for the project area should be substituted in the baseline and project methods. Key factors to consider are climate zone[6], precipitation, building standards, end-user behavior, and transportation environment (land use and transportation characteristics). Use metrics likely to vary outside of California include:

- Building Energy Use
- Water Use
- Vehicle Trip Lengths and Vehicle Miles Traveled
- Building Standards
- Waste Disposal Rates
- Landscape Equipment Annual Usage

Emission factors relate the use metric to carbon intensity to estimate GHG emissions. Depending on the type of emission factor, these values may or may not change based on location. For instance, the emission factor for combustion of a specific amount of fuel does not typically change; however the engine mix may change by location, and fuel use by those engines may be different. Other emission factors are regionally dependent and alternative sources should be investigated. Emission factors likely to vary outside of California include:

- Electricity associated with water and wastewater supply and treatment
- Carbon intensity of electricity supplied
- Fleet and model year distribution of vehicles which influences emission factors

The user should be able to adjust the methodologies to: (1) calculate the baseline for a given mitigation measure; and then (2) incorporate the appropriate data and assumptions into the calculations for the emission mitigation associated with the measure.

There is at least one mitigation measure that will not be applicable outside of California unless adjustments are made by substituting location-specific factors in the baseline methodology: the improvement beyond Title 24 (BE-1) is not applicable outside of California since buildings outside California would be subject to different building codes. The project Applicant may be able to estimate a baseline energy use for building envelope systems under other building standards and estimate the change in energy use for improvements to building envelope systems using building energy software or literature surveys.

[6] Climate zones are specific geographic areas of similar climatic characteristics, including temperature, weather, and other factors which affect building energy use. The California Energy Commission identified 16 Forecasting Climate Zones (FCZs) within California.

How to Use a Fact Sheet to Quantify a Project

This section provides step-by-step instructions and an example regarding how a fact sheet can be used. After choosing the appropriate fact sheet(s), follow these general steps. Steps may need to be adjusted for different types of fact sheets.

Step 1: Does this fact sheet apply?
Carefully read the measure's description and applicability to ensure that you are using the correct fact sheet.

Step 2: Is the measure "grouped"?
Check Tables 6-1 to 6-9 to see if the measure is "grouped" with other measures. If it is, then all measures in the group must be implemented together.

Step 3: Review defaults
Review the default assumptions in the fact sheet.

Step 4: Data inputs
Determine the type of data and data sources necessary. Refer to Appendix B and other suggested documents.

Step 5: Calculate baseline emissions
Calculate baseline emissions using formulas provided in the fact sheet.

Step 6: Percent reductions
If applicable, calculate the percent reduction for the specific action in the measure.

Step 7: Quantify reductions
Quantify emission reductions for a particular mitigation measure using the provided formula.

Step 8: Grouped measures
If you are using a mitigation measure that is grouped with another measure, refer to Tables 6-1 to 6-9 and complete the calculations for all measures that are grouped together for a particular mitigation strategy.

Step 9: Multiple measures
See Chapter 6 for how to combine reductions from multiple measures.

IMPORTANT: Clearly document information such as data sources, data used, and calculations.

Example:

The following is an example calculation for a building project that will use Fact Sheet 2.1.1 - *Exceed Title 24 Building Envelope Energy Efficiency Standards by X%*. In this example, a large office building is being built, and it will be designed to do 10% more than Title 24 standards for both electricity and natural gas.

- **Step 1 – Does this fact sheet apply?**
  The project and fact sheet have been reviewed, and YES, this fact sheet is appropriate to use to estimate reductions from the project.

- **Step 2 - Is the measure "grouped"?**
NO, this is a measure that does not have to be done with other measures.

- **Step 3 – Review defaults**
Default assumptions and emission factors have been reviewed and used, as appropriate.

- **Steps 4 – Data inputs**
The table below shows the data needed for the example, the sample data input, and the source of the sample data. Make sure the data use the units specified in the equation. *

Data for Fact Sheet 2.1.1 Example

Data Needed	Input	Source of Data
Project type	Commercial land use = Large Office	User Input
Size	100,000 sq. ft	User Input
Climate Zone	1	From Figure BE 1.1
Electricity $Intensity_{baseline}$	8.32 kWh/SF/yr	From Fact Sheet 2.1.1
Utility Provider	PG&E	User Input
Emission $Factor_{Electricity}$	2.08E-4 MT CO_2e/kWh	Fact Sheet 2.1.1
Natural Gas $Intensity_{baseline}$	18.16 kBTU/SF/yr	From Fact Sheet 2.1.1
Emission $Factor_{NaturalGas}$	5.32E-5 MT CO_2e/therm	From Fact Sheet 2.1.1
% Reduction Commitment	10% over 2008 Title 24 Standards	User Input

- **Step 5 – Calculate baseline emissions**
Once all necessary information has been obtained, use the equation provided to determine the baseline emissions. Round results to the nearest MT.

⇨ GHG Emissions $Baseline_{Electicity}$ = Electricity $Intensity_{Baseline}$ x Size x Emission $Factor_{Electricity}$

= 8.32 kWh/SF/yr x 100,000 SF x (2.08E-4 MT CO_2e/kWh)
= **173 MT CO_2e/yr [Baseline GHG Emissions for Electricity]**

⇨ GHG Emissions $Baseline_{Natural\ Gas}$ = Natural Gas $Intensity_{Baseline}$ x Size x Emission $Factor_{NaturalGas}$

= 18.16 kBTU/SF/yr x 100,000 SF x (5.32E-5 MT CO_2e/kBTU)
= **97 MT CO_2e/yr [Baseline GHG Emissions for Natural Gas]**

⇨ GHG $Emissions_{Baseline}$ = GHG Emissions $Baseline_{Electricity}$ + GHG Emissions $Baseline_{Natural\ Gas}$

= 173 MT CO_2e/yr + 97 MT CO_2e/yr
= 270 MT CO_2e/yr

- **Step 6 – Percent reductions**

Now calculate the percent GHG emission reduction based on the stated improvement goal. In this example the goal is a 10% reduction over Title 24 Energy Efficiency Standards. See Table BE-1.1 for data used for this step.

⇨ $\text{Reduction}_{\text{Electricity}}$ from 1% over 2008 Title 24 Standards = 0.20%
$\text{Reduction}_{\text{NaturalGas}}$ from 1% over 2008 Title 24 Standards = 1.00%

From Table BE-1.1

⇨ Multiply the Percent Factor from Table BE-1.1 by the Percent Reduction Commitment (10% for this example)

Reduction in GHG emissions from electricity generation:

= 0.20% x 10
= 2%

Reduction Percentage X 10% goal

Reduction in GHG emissions from natural gas combustion:

= 1% x 10
= 10%

Reduction Percentage X 10% goal

- **Step 7 – Quantify reductions**
Using the percent reductions, the emission reductions can be calculated, as shown below.

⇨ Total Building GHG emissions = GHG Emissions $\text{Baseline}_{\text{Electricity.}}$ x ($\text{Reduction}_{\text{Electricity}}$)
+ GHG Emissions $\text{Baseline}_{\text{NaturalGas}}$x ($\text{Reduction}_{\text{NaturalGas}}$)

= 173 MT CO_2e/yr x $(\frac{100\%-2\%}{100})$ + 97 MT CO_2e/yr x $(\frac{100\%-10\%}{100})$
= **257 MT CO_2e/yr**

Net reductions are the difference between the baseline emissions and the emissions calculated above for what will occur with this strategy implemented.

⇨ Net reductions = Baseline – Total Building GHG Emissions

= 270 MT CO_2e/yr - 257 MT CO_2e/yr
= **13 MT CO_2e/yr**

This shows that a 10% improvement in energy consumption over 2008 Title 24 Standards from electricity and natural gas will result in a GHG reduction of 13 MT CO_2e/yr.

- **Step 8 – Grouped measures**
  In this example, the measure is not grouped. For grouped measures, refer to Tables 6-1 to 6-9 in Chapter 6 for how to combine reductions.

- **Step 9 – Multiple measures**
  See “Rules for Combining Strategies or Measures” section in Chapter 6 for how to add reductions from multiple measures

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1.0 Introduction

Chapter 7 is made up of a series of Fact Sheets. Each sheet summarizes the quantification methodology for a specific mitigation measure. As described in Chapter 6, the measures are grouped into Categories, and, in some cases, into subcategories. For information about the development of the Fact Sheets, please see Chapter 4. For a discussion of specific quantification issues in select measure categories or subcategories, please refer to Chapter 5. Chapter 6 provides a detailed explanation of the organization and layout of the Fact Sheets, including rules that govern the quantification of measures that have been, or will be, implemented in combination.

In order to facilitate navigation through, and the use of, the Fact Sheets, they have been color coded to reflect the Category the measure is in, and if applicable, the subcategory. The color scheme is shown in Charts 6-1 and 6-2, and also in Table 7-1 (below).

The colored bar at the top of each Fact Sheet corresponds to the Category color as shown in Charts 6-1 and 6-2, and in Table 7-1; the Category name is shown in the colored bar at the left hand margin. The second colored bar, immediately below the first one, shows the name of the subcategory, if any, and corresponds to subcategory color in those charts and tables. The subcategory name appears at the right hand margin.

At the left hand margin, below the Category name, is a cross-reference to the corresponding measure in the previous two CAPCOA reports (*CEQA and GHG*; and *Model Polices for GHG in General Plans*). The term “MP#” refers to a measure in the Model Policies document. The term CEQA# refers to a measure in the CEQA and GHG report.

At the bottom of the page is a colored bar that corresponds to the Category, and, where applicable, there is a colored box at the right hand margin, contiguous with the colored bar. This color of the box corresponds to the subcategory, where applicable. The box contains the measure number.

The layout of information in each Fact Sheet is covered in detail in Chapter 6.

Table 7-1, below, provides an index and cross-reference for the measure Fact Sheets. It is color-coded, as explained above, and may be used as a key to more quickly and easily navigate through the Fact Sheets

Table 7-1: Measure Index & Cross Reference

Section		Category	Page #	Measure #	BMP	MP #	CEQA #
2.0		Energy	85				
2.1		Building Energy Use	85				
	2.1.1	Buildings Exceed Title 24 Building Envelope Energy Efficiency Standards By X%	85	BE-1		EE-2	MM-E6
	2.1.2	Install Programmable Thermostat Timers	99	BE-2	x	EE-2	-
	2.1.3	Obtain Third-party HVAC Commissioning and Verification of Energy Savings	101	BE-3	x	EE-2	-
	2.1.4	Install Energy Efficient Appliances	103	BE-4		EE-2.1.6	MM E-19
	2.1.5	Install Energy Efficient Boilers	111	BE-5		-	-
2.2		Lighting	115				
	2.2.1	Install Higher Efficacy Public Street and Area Lighting	115	LE-1		EE-2.1.5	-
	2.2.2	Limit Outdoor Lighting Requirements	119	LE-2	x	EE-2.3	
	2.2.3	Replace Traffic Lights with LED Traffic Lights	122	LE-3		EE-2.1.5	-
2.3		Alternative Energy Generation	125				
	2.3.1	Establish Onsite Renewable Energy Systems-Generic	125	AE-1		AE-2.1	MM E-5
	2.3.2	Establish Onsite Renewable Energy Systems-Solar Power	128	AE-2		AE-2.1	MM E-5
	2.3.3	Establish Onsite Renewable Energy Systems-Wind Power	132	AE-3		AE-2.1	MM E-5
	2.3.4	Utilize a Combined Heat and Power System	135	AE-4		AE-2	-
	2.3.5	Establish Methane Recovery in Landfills	143	AE-5		WRD-1	-
	2.3.6	Establish Methane Recovery in Wastewater Treatment Plants	149	AE-6			
3.0		Transportation	155				
3.1		Land Use/Location	155				
	3.1.1	Increase Density	155	LUT-1		LU-1.5 & LU-2.1.8	MM D-1 & D-4
	3.1.2	Increase Location Efficiency	159	LUT-2		LU-3.3	-
	3.1.3	Increase Diversity of Urban and Suburban Developments (Mixed Use)	162	LUT-3		LU-2	MM D-9 & D-4
	3.1.4	Increase Destination Accessibility	167	LUT-4		LU-2.1.4	MM D-3
	3.1.5	Increase Transit Accessibility	171	LUT-5		LU-1,LU-4	MM D-2
	3.1.6	Integrate Affordable and Below Market Rate Housing	176	LUT-6		LU-2.1.8	MM D-7
	3.1.7	Orient Project Toward Non-Auto Corridor	179	LUT-7		LU-4.2	LUT-3
	3.1.8	Locate Project near Bike Path/Bike Lane	181	LUT-8		-	LUT-4
	3.1.9	Improve Design of Development	182	LUT-9		-	-
3.2		Neighborhood/Site Enhancements	186				
	3.2.1	Provide Pedestrian Network Improvements	186	SDT-1		LU-4	MM-T-6
	3.2.2	Provide Traffic Calming Measures	190	SDT-2		LU-1.6	MM-T-8
	3.2.3	Implement a Neighborhood Electric Vehicle (NEV) Network	194	SDT-3		TR-6	MM-D-6
	3.2.4	Create Urban Non-Motorized Zones	198	SDT-4		LU-3.2.1 & 4.1.4	SDT-1
	3.2.5	Incorporate Bike Lane Street Design (on-site)	200	SDT-5		TR-4.1	LUT-9
	3.2.6	Provide Bike Parking in Non-Residential Projects	202	SDT-6		TR-4.1	MM T-1
	3.2.7	Provide Bike Parking with Multi-Unit Residential Projects	204	SDT-7		TR-4.1.2	MM T-3
	3.2.8	Provide Electric Vehicle Parking	205	SDT-8		TR-5.4	MM T-17 & E-11
	3.2.9	Dedicate Land for Bike Trails	206	SDT-9		TR-4.1	LUT-9
3.3		Parking Policy/Pricing	207				
	3.3.1	Limit Parking Supply	207	PDT-1		LU-1.7 & LU-2.1.1.4	-
	3.3.2	Unbundle Parking Costs from Property Cost	210	PDT-2		LU-1.7	-
	3.3.3	Implement Market Price Public Parking (On-Street)	213	PDT-3		-	-
	3.3.4	Require Residential Area Parking Permits	217	PDT-4		-	PDT-1, PDT-2, PDT-3

2.0 Energy

2.1 Building Energy Use

To determine overall reductions, the ratio of building energy associated GHG emissions to the other project categories needs to be determined. This percent contribution to the total is multiplied by the percentage reduction.

2.1.1 Buildings Exceed Title 24 Building Envelope Energy Efficiency Standards By X%[1]

(X is equal to the percentage improvement selected by Applicant such as 5%, 10%, or 20%)

Range of Effectiveness:

For a 10% improvement beyond Title 24 the range of effectiveness is:

	Electricity	Natural Gas
Non-residential	0.2 – 5.5%	0.7 – 10%
Residential	0.3 – 2.6%	7.5 – 9.1%

This is dependent on building type and climate zones.

Measure Description:

Greenhouse gases (GHGs) are emitted as a result of activities in residential and commercial buildings when electricity and natural gas are used as energy sources. New California buildings must be designed to meet the building energy efficiency standards of Title 24, also known as the California Building Standards Code. Title 24 Part 6 regulates energy uses including space heating and cooling, hot water heating, and ventilation[2]. By committing to a percent improvement over Title 24, a development reduces its energy use and resulting GHG emissions.

[1] Compliance with Title 24 is determined from the total daily valuation (TDV) of energy use in the built-environment (on a per square foot per year basis). TDV energy use is a parameter that reflects the burden that a building imposes on an electricity supply system. In general, there is a larger electricity demand and, hence, stress on the supply system during the day (peak times) than at night (off peak). Since a TDV analysis requires significant knowledge about the actual building which is not typically available during the CEQA process, the estimate of the energy and GHG savings from an improvement over Title 24 energy use from a TDV basis is proportional to the actual energy use.

[2] Hardwired lighting is part of Title 24 part 6. However, it is not part of the building envelope energy use and therefore not considered as part of this mitigation measure.

The energy use of a building is dependent on the building type, size and climate zone it is located in.

The *California Commercial Energy Use Survey* (CEUS) and *Residential Appliance Saturation Survey* (RASS) datasets can be used for these calculations since the data is scalable size and available for several land use categories in different climate zones in California.

The Title 24 standards have been updated twice (in 2005 and 2008) since some of these data were compiled. The California Energy Commission (CEC) has published reports estimating the percentage deductions in energy use resulting from these new standards. Based on CEC's discussion on average savings for Title 24 improvements, these CEC savings percentages by end user can be used to account for reductions in electricity and natural gas use due to updates to Title 24. Since energy use for each different system type (i.e., heating, cooling, water heating, and ventilation) as well as appliances is defined, this method will also easily allow for application of mitigation measures aimed at reducing the energy use of these devices in a prescriptive manner.

Measure Applicability:

- Electricity and natural gas use in residential and commercial buildings subject to California's Title 24 building requirements.
- This measure is part of a grouped measure. To ensure the measure effectiveness, this measure also requires third-party HVAC commissioning and verification of energy savings such as including the results from an alternative compliance model indicating the energy savings.

Inputs:

The following information needs to be provided by the Project Applicant:

- Square footage of non-residential buildings
- Number of dwelling units
- Building/Housing Type
- Climate Zone[3]
- Total electricity demand (KWh) per dwelling unit or per square feet
- % reduction commitment (over 2008 Title 24 standards)

Baseline Method:

The baseline GHG emissions from electricity and natural gas usage (reflecting 2008 Title 24 standards with no energy-efficient appliances) are calculated as follows:

[3] See Figure BE-1.1.

$\text{GHG Emissions Baseline}_{\text{Electricity}}$ = $\text{Electricity Intensity}_{\text{baseline}}$ x Size x $\text{Emission Factor}_{\text{Electricity}}$

$\text{GHG Emissions Baseline}_{\text{NaturalGas}}$ = $\text{Natural Gas Intensity}_{\text{baseline}}$ x Size x $\text{Emission Factor}_{\text{NaturalGas}}$

Where:

$\text{Electricity Intensity}_{\text{baseline}}$ = Total electricity demand (kWh) per dwelling unit or per square foot; provided by applicant and adjusted for 2008 Title 24 standards (calculated based on CEUS and RASS)[4]

$\text{Natural Gas Intensity}_{\text{baseline}}$ = Total natural gas demand (kBTU or therms) per dwelling unit or per square foot; provided by applicant and adjusted for 2008 Title 24 standards (calculated based on CEUS and RASS)[5]

$\text{Emission Factor}_{\text{Electricity}}$ = Carbon intensity of local utility (CO_2e/kWh)[6]

$\text{Emission Factor}_{\text{NaturalGas}}$ = Carbon intensity of natural gas use (CO_2e/kBTU or CO_2e/therm)[7]

Size = Number of dwelling units or square footage of commercial land uses

Mitigation Method:

GHG reduction % $_{\text{Mitigated\_Electricity}}$ = $\text{Reduction}_{\text{Electricity}}$ x Reduction Commitment

GHG reduction % $_{\text{Mitigated\_NaturalGas}}$ = $\text{Reduction}_{\text{NaturalGas}}$ x Reduction Commitment

Where:

Reduction = Applicable reduction based on climate zone, building type, and energy type from Tables BE-1.1 and BE-1.2

Reduction Commitment = Project's reduction commitment beyond 2008 Title 24 standards (expressed as a whole number)

This should be done for each individual building type. If the project involves multiple building types or only a percentage of buildings will have reductions the total for all buildings needs to be determined. This percentage should be applied as follows and summed over all buildings types:

---

[4] See Appendix B for baseline inventory calculation methodologies to assist in determining these values.
[5] See Appendix B for baseline inventory calculation methodologies to assist in determining these values.
[6] Ibid.
[7] Ibid.

$$\sum_i (Reduction \times Commitment)\left(\frac{buildingGHG_i}{TotalGHG_i}\right)(\%BuildingType)$$

$buildingGHG_i$	=	GHG emissions for specific building type for either electricity or natural gas
$TotalGHG_i$	=	Total GHG emissions for all buildings for either electricity or natural gas
i	=	electricity or natural gas
$\%BuildingType$	=	portion of building(s) of this type

Tables BE-1.1 and BE-1.2 tabulate the percent reductions from building energy use for each land use type in the various climate zones in California. There is one table for residential land uses and another for non-residential land uses. There is a column for electricity reductions and another for natural gas reductions.

Assumptions:

See Figure BE-1.1 below for a map showing the 16 Climate Zones. Data for some Climate Zones is not presented in the CEUS and RASS studies. However, data from similar Climate Zones is representative and can be used as follows:

For non-residential building types:

Climate Zone 9 should be used for Climate Zone 11.
Climate Zone 9 should be used for Climate Zone 12.
Climate Zone 1 should be used for Climate Zone 14.
Climate Zone 10 should be used for Climate Zone 15.

For residential building types:

Climate Zone 2 should be used for Climate Zone 6.
Climate Zone 1 should be used for Climate Zone 14.
Climate Zone 10 should be used for Climate Zone 15.

Data based upon the following references:

- CEC. 2009. Residential Compliance Manual for California's 2008 Energy Efficiency Standards. Available online at: http://www.energy.ca.gov/title24/2008standards/residential_manual.html
- CEC. 2009. Nonresidential Compliance Manual for California's 2008 Energy Efficiency Standards. Available online at: http://www.energy.ca.gov/title24/2008standards/nonresidential_manual.html
- CEC. 2004. Residential Appliance Saturation Survey. Available online at: http://www.energy.ca.gov/appliances/rass/

- CEC. 2006. Commercial End-Use Survey. Available online at: http://www.energy.ca.gov/ceus/

Emission Reduction Ranges and Variables:

[Refer to Attached Tables BE-1.1 and BE-1.2 for climate zone and land use specific percentages]

This information uses 2008 Title 24 information. To adjust to 2005 Title 24, see Table BE-1.3.

Pollutant	Category Emissions Reductions
CO_2e	See Tables BE-1.1 and BE-1.2 for percentage reductions for every 1% improvement over 2008 Title 24.
PM	See Tables BE-1.1 and BE-1.2 for percentage reduction from natural gas. There is no reduction for electricity.
CO	See Tables BE-1.1 and BE-1.2 for percentage reduction from natural gas. There is no reduction for electricity.
SO_2	See Tables BE-1.1 and BE-1.2 for percentage reduction from natural gas. There is no reduction for electricity.
NOx	See Tables BE-1.1 and BE-1.2 for percentage reduction from natural gas. There is no reduction for electricity.

Discussion:

If the applicant selects to commit beyond requirements for 2008 Title 24 standards, the applicant would reduce the amount of GHG emissions associated with electricity generation and natural gas combustion.

Example:

Commercial land use = Large Office

Square footage = 100,000 sq. ft.

Climate Zone = 1

Utility Provider = PG&E

% Reduction Commitment = 10% over 2008 Title 24 Standards

Electricity $Intensity_{baseline}$ = 8.32 kWh/SF/yr (adjusted to reflect 2008 Title 24 standards)

Emission $Factor_{Electricity}$ = 2.08E-4 MT CO_2e/kWh

Electricity $Emissions_{baseline}$ = 8.32 kWh/SF/yr x 100,000 SF x (2.08E-4 MT CO_2e/kWh)
= 173 MT CO_2e/yr

Natural Gas $Intensity_{baseline}$ = 18.16 kBTU/SF/yr (adjusted to reflect 2008 Title 24 standards)

Emission $Factor_{NaturalGas}$ = 5.32E-5 MT CO_2e/therm

Natural Gas $Emissions_{baseline}$ = 18.16 kBTU/SF/yr x 100,000 SF x (5.32E-5 MT CO_2e/kBTU)
= 97 MT CO_2e/yr

GHG $emissions_{baseline}$ = 173 MT CO_2e/yr + 97 MT CO_2e/yr
= 270 MT CO_2e/yr

From Table BE-1.1:

$Reduction_{Electricity}$ from 1% over 2008 Title 24 Standards = 0.20%
$Reduction_{NaturalGas}$ from 1% over 2008 Title 24 Standards = 1.00%

Reduction in GHG emissions from electricity generation: 0.20% x 10 = 2%
Reduction in GHG emissions from natural gas combustion: 1% x 10 = 10%
Mitigated Building GHG emissions = 173 MT CO_2e/yr x (100% - 2%) + 97 MT CO_2e/yr x (100% - 10%) = 257 CO_2e/yr

Preferred Literature:

GHG reductions from a percent improvement over Title 24 can be quantified by calculating baseline energy usage using methodologies based on the California Energy Commission (CEC)'s Residential Appliance Saturation Survey (RASS) and Commercial End-Use Survey (CEUS), or an applicable Alternative Calculation Method (ACM). RASS and CEUS data are based on CEC Forecasting Climate Zones (FCZs); therefore, differences in project energy usage due to different climates are accounted for. The percent improvement is applied to Title 24 built environment energy uses, and overall GHG emissions are calculated using local utility emission factors. This methodology allows the Project Applicant flexibility in choosing which specific measures it will pursue to achieve the percent reductions (for example, installing higher quality building insulation, or installing a more efficient water heating system), while still making the mitigation commitment at the time of California Environmental Quality Act (CEQA) analysis.

Alternative Literature:

Alternatively, a Project Applicant could use the “prescriptive package” approach to demonstrate compliance with Title 24. Using this approach, the Project Applicant would commit to specific design elements above Title 24 prescriptive package requirements at the time of CEQA analysis, such as using solar water heating or improved insulation. Rather than calculating an overall percent reduction in GHG emissions based on an overall baseline value as presented above, the prescriptive approach requires the Project Applicant to break down building energy use by end-use. The Project Applicant would need to provide substantial evidence supporting the GHG reductions attributable to mitigation measures for each end-use. There are several references for quantifying GHG reductions from prescriptive measures. One example of a prescriptive measure is installing tankless or on-demand water heaters. These systems use a gas burner or electric element to heat water as needed and therefore do not use energy to store heated water. According to the U.S. Department of Energy (USDOE), typical tankless water heaters can be 24-34% more energy efficient than conventional storage tank water heaters [1]. Another example of a prescriptive measure is installing geothermal (ground-source or water-source) heat pumps. This measure takes advantage of the fact that the temperature beneath the ground surface is relatively constant. Fluid circulating through underground pipe loops is either heated or cooled and the heat is either upgraded or reduced in the heat pump depending on whether the building requires heating or cooling [2]. United States Environmental Protection Agency (USEPA) reports that ENERGY STAR - qualified geothermal heat pump systems are 30-45% more efficient than conventional heat pumps [3].

Alternative Literature References:

[1] USDOE. Energy Savers: Demand (Tankless or Instantaneous) Water Heaters. Accessed February 2010. Available online at: http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12820

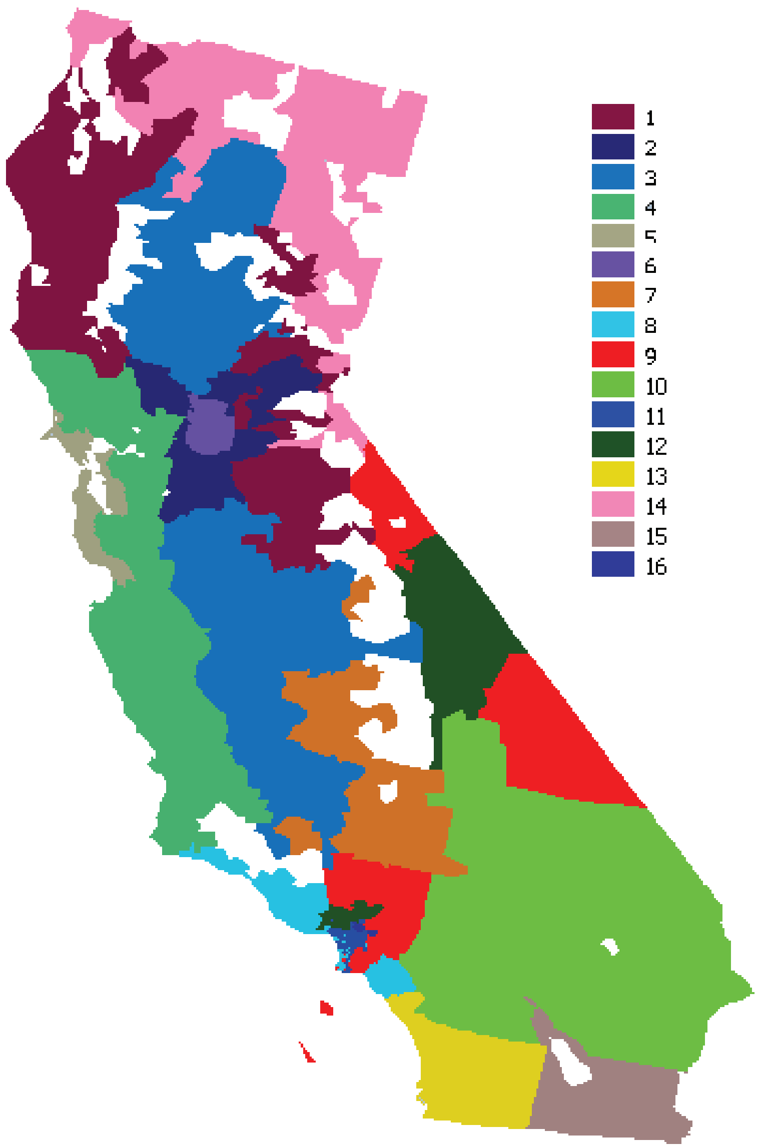
[2] CEC. Consumer Energy Center: Geothermal or Ground Source Heat Pumps. Accessed February 2010. Available online at: http://www.consumerenergycenter.org/home/heating_cooling/geothermal.html

[3] USEPA. ENERGY STAR: Heat Pumps, Geothermal. Accessed February 2010. Available online at: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=HP

Other Literature Reviewed:

None

Figure BE-1.1
CEC Forecast Climate Zones[8,9]



[8] Adapted from Figure 2 of CEC. 2004. Residential Appliance Saturation Survey. Available online at: http://www.energy.ca.gov/appliances/rass/
[9] White spaces represent national parks and forests.

Table BE-1.1
Non-Residential
Reduction for 1% Improvement over 2008 Title 24

Climate Zone	Building Types	Reduction	
		Electricity	Natural Gas
1	All Commercial	0.22%	0.76%
	All Office	0.36%	1.00%
	All Warehouses	0.02%	0.00%
	College	0.28%	1.00%
	Grocery	0.08%	0.96%
	Health	0.33%	1.00%
	Large Office	0.20%	1.00%
	Lodging	0.30%	1.00%
	Miscellaneous	0.16%	0.91%
	Refrigerated Warehouse	0.02%	0.00%
	Restaurant	0.19%	0.25%
	Retail	0.40%	1.00%
	School	0.26%	0.94%
	Small Office	0.37%	1.00%
	Unrefrigerated Warehouse	0.00%	0.00%
2	All Commercial	0.24%	0.86%
	All Office	0.35%	0.97%
	All Warehouses	0.07%	1.00%
	College	0.45%	1.00%
	Grocery	0.17%	1.00%
	Health	0.35%	0.72%
	Large Office	0.31%	1.00%
	Lodging	0.30%	0.99%
	Miscellaneous	0.22%	1.00%
	Refrigerated Warehouse	0.02%	1.00%
	Restaurant	0.22%	0.38%
	Retail	0.36%	0.97%
	School	0.36%	0.96%
	Small Office	0.38%	0.96%
	Unrefrigerated Warehouse	0.12%	1.00%
3	All Commercial	0.26%	0.66%
	All Office	0.32%	0.98%
	All Warehouses	0.03%	0.95%
	College	0.28%	0.94%
	Grocery	0.14%	0.53%
	Health	0.43%	0.82%
	Large Office	0.34%	0.97%
	Lodging	0.55%	0.73%

Climate Zone	Building Types	Reduction	
		Electricity	**Natural Gas**
	Miscellaneous	0.25%	0.82%
	Refrigerated Warehouse	0.02%	1.00%
	Restaurant	0.26%	0.18%
	Retail	0.29%	0.81%
	School	0.33%	0.93%
	Small Office	0.30%	1.00%
	Unrefrigerated Warehouse	0.13%	0.94%
4	All Commercial	0.27%	0.71%
	All Office	0.38%	1.00%
	All Warehouses	0.06%	0.77%
	College	0.37%	0.87%
	Grocery	0.12%	0.75%
	Health	0.45%	0.85%
	Large Office	0.41%	1.00%
	Lodging	0.30%	0.90%
	Miscellaneous	0.20%	0.76%
	Refrigerated Warehouse	0.02%	0.20%
	Restaurant	0.18%	0.30%
	Retail	0.29%	1.00%
	School	0.32%	0.95%
	Small Office	0.30%	1.00%
	Unrefrigerated Warehouse	0.10%	0.98%
5	All Commercial	0.26%	0.72%
	All Office	0.36%	0.95%
	All Warehouses	0.06%	0.46%
	College	0.44%	0.98%
	Grocery	0.09%	0.67%
	Health	0.40%	0.84%
	Large Office	0.37%	0.94%
	Lodging	0.29%	0.81%
	Miscellaneous	0.18%	0.73%
	Refrigerated Warehouse	0.04%	0.29%
	Restaurant	0.11%	0.25%
	Retail	0.24%	0.85%
	School	0.16%	0.91%
	Small Office	0.29%	1.00%
	Unrefrigerated Warehouse	0.07%	0.85%
6	All Commercial	0.31%	0.73%
	All Office	0.38%	0.95%
	All Warehouses	0.07%	0.86%
	College	0.43%	0.99%

Climate Zone	Building Types	Reduction	
		Electricity	Natural Gas
	Grocery	0.16%	0.64%
	Health	0.46%	0.86%
	Large Office	0.39%	0.94%
	Lodging	0.40%	0.86%
	Miscellaneous	0.25%	0.66%
	Refrigerated Warehouse	0.03%	0.58%
	Restaurant	0.24%	0.35%
	Retail	0.31%	0.83%
	School	0.31%	0.96%
	Small Office	0.34%	1.00%
	Unrefrigerated Warehouse	0.09%	1.00%
7	All Commercial	0.25%	0.88%
	All Office	0.32%	0.94%
	All Warehouses	0.02%	0.64%
	College	0.25%	0.99%
	Grocery	0.12%	0.90%
	Health	0.32%	0.93%
	Large Office	0.34%	1.00%
	Lodging	0.41%	0.94%
	Miscellaneous	0.18%	0.99%
	Refrigerated Warehouse	0.02%	0.64%
	Restaurant	0.27%	0.19%
	Retail	0.34%	0.99%
	School	0.29%	0.96%
	Small Office	0.31%	0.91%
	Unrefrigerated Warehouse	0.00%	0.00%
8	All Commercial	0.30%	0.62%
	All Office	0.37%	0.94%
	All Warehouses	0.12%	0.99%
	College	0.43%	0.67%
	Grocery	0.14%	0.50%
	Health	0.45%	0.85%
	Large Office	0.38%	0.94%
	Lodging	0.34%	0.86%
	Miscellaneous	0.22%	0.68%
	Refrigerated Warehouse	0.02%	0.93%
	Restaurant	0.27%	0.31%
	Retail	0.28%	0.49%
	School	0.33%	0.92%
	Small Office	0.33%	0.96%
	Unrefrigerated Warehouse	0.16%	0.99%

Climate Zone	Building Types	Reduction	
		Electricity	Natural Gas
9	All Commercial	0.28%	0.60%
	All Office	0.39%	0.96%
	All Warehouses	0.13%	0.95%
	College	0.33%	0.98%
	Grocery	0.14%	0.46%
	Health	0.44%	0.85%
	Large Office	0.43%	0.98%
	Lodging	0.37%	0.84%
	Miscellaneous	0.23%	0.76%
	Refrigerated Warehouse	0.03%	0.91%
	Restaurant	0.21%	0.19%
	Retail	0.32%	0.71%
	School	0.32%	0.90%
	Small Office	0.31%	0.94%
	Unrefrigerated Warehouse	0.18%	0.96%
10	All Commercial	0.30%	0.61%
	All Office	0.35%	1.00%
	All Warehouses	0.11%	0.58%
	College	0.27%	1.00%
	Grocery	0.19%	0.67%
	Health	0.46%	0.92%
	Large Office	0.34%	1.00%
	Lodging	0.39%	0.92%
	Miscellaneous	0.24%	0.49%
	Refrigerated Warehouse	0.03%	0.07%
	Restaurant	0.29%	0.29%
	Retail	0.36%	0.87%
	School	0.37%	0.80%
	Small Office	0.36%	1.00%
	Unrefrigerated Warehouse	0.15%	0.98%
13	All Commercial	0.29%	0.66%
	All Office	0.38%	0.80%
	All Warehouses	0.19%	0.95%
	College	0.33%	0.86%
	Grocery	0.11%	0.40%
	Health	0.39%	0.88%
	Large Office	0.41%	0.80%
	Lodging	0.40%	0.82%
	Miscellaneous	0.17%	0.39%

Climate Zone	Building Types	Reduction	
		Electricity	Natural Gas
	Refrigerated Warehouse	0.07%	1.00%
	Restaurant	0.24%	0.21%
	Retail	0.28%	0.53%
	School	0.31%	0.92%
	Small Office	0.32%	0.76%
	Unrefrigerated Warehouse	0.26%	0.93%

Table BE-1.2
Residential
Reduction for 1% Improvement over 2008 Title 24

Climate Zone	Housing	Reduction	
		Electricity	Natural Gas
1	Multi	0.24%	0.86%
	Single	0.17%	0.87%
	Townhome	0.22%	0.87%
2	Multi	0.15%	0.89%
	Single	0.14%	0.91%
	Townhome	0.11%	0.89%
3	Multi	0.23%	0.90%
	Single	0.18%	0.91%
	Townhome	0.16%	0.90%
4	Multi	0.12%	0.88%
	Single	0.09%	0.91%
	Townhome	0.09%	0.90%
5	Multi	0.09%	0.88%
	Single	0.04%	0.91%
	Townhome	0.05%	0.90%
7	Multi	0.25%	0.87%
	Single	0.16%	0.88%
	Townhome	0.18%	0.85%
8	Multi	0.09%	0.77%
	Single	0.07%	0.82%
	Townhome	0.07%	0.80%
9	Multi	0.08%	0.77%
	Single	0.11%	0.82%
	Townhome	0.09%	0.80%
10	Multi	0.26%	0.80%
	Single	0.18%	0.83%
	Townhome	0.22%	0.81%

11	Multi	0.05%	0.77%
	Single	0.05%	0.83%
	Townhome	0.03%	0.81%
12	Multi	0.15%	0.75%
	Single	0.15%	0.83%
	Townhome	0.13%	0.80%
13	Multi	0.09%	0.79%
	Single	0.06%	0.83%
	Townhome	0.05%	0.81%

2.1.2 Install Programmable Thermostat Timers

Range of Effectiveness:

Best Management Practice influences building energy use for heating and cooling.

Measure Description:

Programmable thermostat timers allow users to easily control when the HVAC system will heat or cool a certain space, thereby saving energy. Because most commercial buildings already have timed HVAC systems, this mitigation measure focuses on residential programmable thermostats.

The DOE reports [1] that residents can save around 10% on heating and cooling bills per year by lowering the thermostat by 10-15 degrees for eight hours[10]. This can be accomplished using an automatic timer or programmable thermostat, such that the heat is reduced while the residents are at work or otherwise out of the house. The energy savings from a programmable thermostat, however, depend on the user. Some users preset the thermostat to heat the house before they come home, thereby increasing energy usage, while others use it to avoid heating the house when they are not home or asleep. Because of the large variability in individual occupant behavior and because it is unclear whether programmable thermostats systematically reduce energy use, this measure cannot be reasonably quantified. This mitigation measure should be incorporated as a Best Management Practice to allow for educated occupants to have the most efficient means at controlling their heating and cooling energy use. In order to take quantitative credit for this mitigation measure, the Project Applicant would need to provide detailed and substantial evidence supporting a reduction in energy use and associated GHG emissions.

Measure Applicability:

- Electricity use in residential dwellings.
- Best Management Practice only.

Assumptions:

Data based upon the following references:

[1] USDOE. Energy Savers: Thermostats and Control Systems. Available online at: http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12720

[10] Such a large drop in thermostat temperatures may not be applicable in parts of California; more applicable may be the raising of the thermostat for airconditioned spaces.

Emission Reduction Ranges and Variables:

This is a best management practice and therefore at this time there is no quantifiable reduction. Check with local agencies for guidance on any allowed reductions associated with implementation of best management practices.

If substantial evidence was provided, the GHG reductions would equal the percent savings in total electricity or natural gas. The total reduction would be:

GHG reduction = (% thermostat reduce heat/cool energy use) x
(% end use heat/cool of total energy use)

Preferred Literature:

The DOE reports [1] that residents can save approximately 10% on heating and cooling bills per year by lowering the thermostat by 10-15 degrees for eight hours. This can be accomplished using an automatic timer or programmable thermostat, such that the heat is reduced while the residents are at work or otherwise out of the house. The energy savings from a programmable thermostat, however, depend on the user. Some users preset the thermostat to heat the house before they come home, thereby increasing energy usage, while others use it to avoid heating the house when they are not home or asleep.

Alternative Literature:

None

Other Literature Reviewed:

Pacific Northwest National Laboratory. 2007. GridWise Demonstration Project Fast Facts. Available online at: http://gridwise.pnl.gov/docs/pnnl_gridwiseoverview.pdf.

2.1.3 Obtain Third-party HVAC Commissioning and Verification of Energy Savings

Range of Effectiveness:

Not applicable on its own. This measure enhances effectiveness of BE-1.

Measure Description:

Ensuring the proper installation and construction of energy reduction features is essential to achieving high thermal efficiency in a house. In practice, HVAC systems commonly do not operate at the designed efficiency due to errors in installation or adjustments. A Project Applicant can obtain HVAC commissioning and third-party verification of energy savings in thermal efficiency components including HVAC systems, insulation, windows, and water heating.

This measure is required to be grouped with measure "Exceed Title 24 Energy Efficiency Standards by X% (BE-1).

Measure Applicability:

- This measure is part of a grouped measure. This measure also requires third-party HVAC commissioning and verification of energy savings.
- Buildings subject to California's Title 24 building requirements.

Preferred Literature:

While Title 24 requires that a home's ducts be tested for leaks whenever the central air conditioner or furnace is installed or replaced, a third-party verifier such as the California Home Energy Efficiency Rating Service (CHEERS) and ENERGY STAR Home Energy Rating Service (HERS) can ensure that ducts were properly sealed [1-3]. These certified raters can also verify other energy efficiency measures, such as HVAC controls, insulation performance, and the air-tightness of the building envelope. Furthermore, these raters can analyze a home and make climate-specific recommendations for further improving the home's energy efficiency. Since this mitigation measure ensures that the building envelope systems are properly installed and sealed, there is no quantifiable reduction for this measure. It is recommended as a Best Management Practice grouped with the Title 24 improvement mitigation measure.

Alternative Literature:

None

Literature References:

[1] California Home Energy Efficiency Rating Services. What is CHEERS? Available online at: http://www.cheers.org/Home/Overview/tabid/124/Default.aspx. Accessed March 2010.

[2] USEPA. ENERGY STAR: Features of ENERGY STAR Qualified New Homes. Available online at: http://www.energystar.gov/index.cfm?c=new_homes.nh_features. Accessed March 2010.

[3] USEPA. ENERGY STAR: Independent Inspection and Testing. Available online at: http://www.energystar.gov/ia/new_homes/features/HERSrater_062906.pdf. Accessed March 2010.

2.1.4 Install Energy Efficient Appliances

Range of Effectiveness:

Residential 2-4% GHG emissions from electricity use. Grocery Stores: 17-22% of GHG emissions from electricity use.

Measure Description:

Using energy-efficient appliances reduces a building's energy consumption as well as the associated GHG emissions from natural gas combustion and electricity production. To take credit for this mitigation measure, the Project Applicant (or contracted builder) would need to ensure that energy efficient appliances are installed. For residential dwellings, typical builder-supplied appliances include refrigerators and dishwashers. Clothes washers and ceiling fans would be applicable if the builder supplied them. For commercial land uses, energy-efficient refrigerators have been evaluated for grocery stores. See Mitigation Method section on how project applicant may quantify additional building types and appliances.

The energy use of a building is dependent on the building type, size and climate zone it is located in. The *California Commercial Energy Use Survey* (CEUS) and *Residential Appliance Saturation Survey* (RASS) datasets for this calculation since the data is scalable by size and available for several land use categories in different climate zones in California. Typical reductions for energy-efficient appliances can be found in the *Energy Star and Other Climate Protection Partnerships 2008 Annual Report* or subsequent Annual Reports. ENERGY STAR refrigerators, clothes washers, dishwashers, and ceiling fans use 15%, 25%, 40%, and 50% less electricity than standard appliances, respectively.

RASS does not specify a ceiling fan end-use; rather, electricity use from ceiling fans is accounted for in the Miscellaneous category which includes interior lighting, attic fans, and other miscellaneous plug-in loads. Since the electricity usage of ceiling fans alone is not specified, a value from the National Renewable Energy Laboratory (NREL) Building American Research Benchmark Definition (BARBD) is used. BARBD reports that the average energy use per ceiling fan is 84.1 kWh per year. In this mitigation measure, it is assumed that each multi-family, single-family, and townhome residence has one ceiling fan. The electricity savings shown here is based on installing an ENERGY STAR ceiling fan and does not account for an occupant's decreased use of cooling devices such as air conditioners. For ceiling fans, the 50% reduction was applied to 84.1 kWh of the electricity attributed to the Miscellaneous RASS category.

Measure Applicability:

- Electricity use in residential dwellings and commercial grocery stores.
- This mitigation measure applies only when appliance installation can be specified as part of the Project.

Inputs:

The following information needs to be provided by the Project Applicant:

- Number of dwelling units and/or size of grocery store
- Climate Zone
- Housing Type (if residential)
- Utility provider
- Total natural gas demand (kBTU or therms) per dwelling unit or per square foot
- Types of energy efficient appliances to be installed (refrigerator, dishwasher, or clothes washer for residential land uses and refrigerators for grocery stores)

Baseline Method:

$$\text{GHG emissions} = \text{Electricity Intensity}_{\text{baseline}} \text{ x Size x Emission Factor}_{\text{Electricity}} + \text{Natural Gas Intensity}_{\text{baseline}} \text{ x Size x Emission Factor}_{\text{NaturalGas}}$$

Where:

GHG emissions = MT CO_2e (reflecting 2008 Title 24 standards with no energy-efficient appliances)

Electricity $\text{Intensity}_{\text{baseline}}$ = Total electricity demand (kWh) per dwelling unit or per square foot; provided by applicant and adjusted for 2008 Title 24 standards[11]

Natural Gas $\text{Intensity}_{\text{baseline}}$ = Total natural gas demand (kBTU or therms) per dwelling unit or per square foot; provided by applicant and adjusted for 2008 Title 24 standards[12]

Emission $\text{Factor}_{\text{Electricity}}$ = Carbon intensity of local utility (CO2e/kWh)[13]

Emission $\text{Factor}_{\text{NaturalGas}}$ = Carbon intensity of natural gas use (CO_2e/kBTU or CO_2e/therm)[14]

Size = Number of dwelling units or square footage of commercial land uses

Mitigation Method:

$$\text{GHG emissions}_{\text{mitigated}} = \text{Electricity Emissions}_{\text{baseline}} \text{ x (1-(Sum of Reductions)) +}$$

[11] See Appendix B for baseline inventory calculation methodologies to assist in determining these values.
[12] Ibid
[13] Ibid.
[14] Ibid.

Natural Gas Emissions$_{baseline}$

Where:

Electricity Emissions$_{baseline}$ = Emissions due to electricity generation, adjusted for 2008 Title 24 Standards (calculated based on CEUS and RASS)

Sum of Reductions = Applicable reduction based on energy efficient appliances installed (expressed as a decimal)

Natural Gas Emissions$_{baseline}$ = Emissions due to natural gas combustion, adjusted for 2008 Title 24 Standards (calculated based on CEUS and RASS)

Building GHG reduction Percentage = [GHG emissions mitigated/GHG emissions baseline]

Tables BE-4.1 and BE-4.2 tabulate the percent reductions from installing specific ENERGY STAR appliances for each land use type in the various climate zones in California. There is one table for residential land uses and another for non-residential land uses. This will only result in reductions associated with electricity use and does not apply to natural gas since there are no major Energy Star appliances that use natural gas. The energy efficient heating, cooling, and water heating systems that may use natural gas are included in improvements over Title 24 (see measure BE-1).

For other building types and energy efficient appliances, the reductions similar to those in the tables can be quantified as follows:

Reduction = (Appliance End Use %) x (1 – efficiency)

Where:

Appliance End Use % = portion of energy for this appliance compared to total electricity use

Efficiency = percent reduction in energy use for efficient appliance compared to standard.

Assumptions:

Data for some Climate Zones is not presented in the CEUS and RASS studies. However, data from similar Climate Zones is representative and can be used as follows:

For non-residential building types:
Climate Zone 9 should be used for Climate Zone 11.
Climate Zone 9 should be used for Climate Zone 12.

Climate Zone 1 should be used for Climate Zone 14.
Climate Zone 10 should be used for Climate Zone 15.
For residential building types:
Climate Zone 2 should be used for Climate Zone 6.
Climate Zone 1 should be used for Climate Zone 14.
Climate Zone 10 should be used for Climate Zone 15.

Data based upon the following references:

[1] USEPA. 2008. ENERGY STAR 2008 Annual Report. Available online at: http://www.epa.gov/cpd/annualreports/annualreports.htm

[2] CEC. 2004. Residential Appliance Saturation Survey. Available online at: http://www.energy.ca.gov/appliances/rass/

[3] CEC. 2006. Commercial End-Use Survey. Available online at: http://www.energy.ca.gov/ceus/

[4] NREL. 2010. Building America Research Benchmark Definition. Available online at: http://www.nrel.gov/docs/fy10osti/47246.pdf

Emission Reduction Ranges and Variables:

[Refer to Attached Tables BE-4.1 and BE-4.2 for climate zone and land use specific percentages]

If more than one type of appliance is considered the percentage for each appliance should be added together.

Pollutant	Category Emissions Reductions
CO_2e	See Tables BE-4.1 and BE-4.2 for percentage reductions.
PM	Not Quantified[15]
CO	Not Quantified
SO_2	Not Quantified
NOx	Not Quantified

Discussion:

If the applicant commits to installing energy efficient appliances, the applicant would reduce the amount of GHG emissions associated with electricity generation because

[15] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

more energy efficient appliances will require less electricity to run. This reduces GHG emissions from power plants.

Example:

Housing Type = Single Family Home

Number of Dwelling Units = 100

Climate Zone = 1

Utility Provider = PG&E

Energy efficient appliances to be installed = refrigerator and dishwasher

Electricity Intensity$_{baseline}$	=	7,196 kWh/DU/yr (adjusted to reflect 2008 Title 24 standards)
Emission Factor$_{Electricity}$	=	2.08E-4 MT /kWh
Electricity Emissions$_{baseline}$	=	7,196 kWh/DU/yr x 100 DU x (2.08E-4 MT CO_2e/kWh)
	=	150 MT CO_2e/yr
Natural Gas Intensity$_{baseline}$	=	365 therms/DU/yr (adjusted to reflect 2008 Title 24 standards)
Emission Factor$_{NaturalGas}$	=	5.32E-3 MT CO_2e/kBTU
Natural Gas Emissions$_{baseline}$	=	365 therm/DU/yr x 100 DU x (5.32E-3 MT CO_2e/therm)
	=	194 MT CO_2e/yr
GHG emissions$_{baseline}$	=	150 MT CO_2e/yr + 194 MT CO_2e/yr
	=	344 MT CO_2e/yr

Sum of Reductions associated with electricity generation from Table BE-4.2 = 2.05%
Reductions associated with natural gas combustion = 0%

GHG emissions$_{mitigated}$ = 150*(1-.0205) + 194

= 341

Building GHG reduction = 1 - 341 / 344 = 0.9%

Preferred Literature:

The USEPA ENERGY STAR Program has identified energy efficient residential and consumer appliances including air conditioners, refrigerators, freezers, clothes washers, dishwashers, fryers, steamers, and vending machines. The ENERGY STAR Annual Report presents the average percent energy savings from using an ENERGY STAR-qualified appliance instead of a standard appliance. GHG emissions reductions are calculated based on local utility emission factors and the baseline appliance energy use derived from the CEC RASS and CEUS methodologies. RASS and CEUS data are climate-specific; therefore, differences in project energy usage due to different climates are accounted for.

Alternative Literature:

None

Other Literature Reviewed:

None

Table BE-4.1
Non-Residential
Reduction for ENERGY STAR Refrigerators in Grocery Stores

Climate Zone	Electricity Reduction
1	20%
2	17%
3	18%
4	21%
5	22%
6	19%
7	18%
8	19%
9	20%
10	18%
13	21%

Table BE-4.2
Residential
Reduction for ENERGY STAR Appliances

Climate Zone	Housing	Refrigerator[1,3]	Clothes Washer[1,3]	Dishwasher[1,3]	Ceiling Fan[2,3]
		Total Electricity Reduction			
1	Multi	2.59%	0.03%	0.10%	1.01%
	Single	1.72%	0.50%	0.12%	0.58%
	Townhome	2.28%	0.28%	0.11%	0.83%
2	Multi	2.86%	0.03%	0.11%	1.12%
	Single	1.79%	0.53%	0.13%	0.61%
	Townhome	2.61%	0.32%	0.13%	0.96%
3	Multi	2.62%	0.03%	0.10%	1.02%
	Single	1.69%	0.50%	0.12%	0.58%
	Townhome	2.44%	0.30%	0.12%	0.89%
4	Multi	2.97%	0.03%	0.12%	1.16%
	Single	1.90%	0.56%	0.14%	0.65%
	Townhome	2.64%	0.33%	0.13%	0.97%
5	Multi	3.07%	0.03%	0.12%	1.20%
	Single	1.99%	0.58%	0.14%	0.68%
	Townhome	2.78%	0.35%	0.14%	1.02%
7	Multi	2.54%	0.03%	0.10%	0.99%
	Single	1.74%	0.51%	0.12%	0.59%
	Townhome	2.39%	0.30%	0.12%	0.88%
8	Multi	3.08%	0.03%	0.12%	1.20%
	Single	1.94%	0.57%	0.14%	0.66%
	Townhome	2.71%	0.34%	0.14%	0.99%
9	Multi	3.13%	0.03%	0.12%	1.22%
	Single	1.85%	0.54%	0.13%	0.63%
	Townhome	2.65%	0.33%	0.13%	0.97%
10	Multi	2.52%	0.03%	0.10%	0.98%
	Single	1.71%	0.50%	0.12%	0.58%
	Townhome	2.27%	0.28%	0.11%	0.83%
11	Multi	3.21%	0.03%	0.13%	1.25%
	Single	1.97%	0.58%	0.14%	0.67%
	Townhome	2.83%	0.35%	0.14%	1.04%
12	Multi	2.89%	0.03%	0.11%	1.13%
	Single	1.76%	0.51%	0.13%	0.60%
	Townhome	2.53%	0.32%	0.13%	0.93%
13	Multi	3.09%	0.03%	0.12%	1.21%
	Single	1.95%	0.57%	0.14%	0.66%
	Townhome	2.76%	0.34%	0.14%	1.01%

Notes:

1. Percent reductions are based on the saturation values presented in RASS. The Project Applicant may use project-specific saturation values (i.e. if 100% of homes have clothes washers, then saturation = 1).

Notes:

2. CEC's RASS does not specify a ceiling fan end-use; rather, electricity use from ceiling fans is accounted for in the Miscellaneous category, which includes interior lighting, attic fans, and other miscellaneous plug-in loads. Since the electricity usage of ceiling fans alone is not specified, a value from NREL's BARBD was used. BARBD reports that the average energy use per ceiling fan is 84.1 kWh per year. In this table, it is assumed that each multi-family, single-family, and townhome residence has one ceiling fan. The electricity savings shown here is based on installing an ENERGY STAR ceiling fan and does not account for an occupant's decreased use of cooling devices such as air conditioners.

3. Total electricity reduction is based on installing ENERGY STAR appliances instead of standard appliances. ENERGY STAR refrigerators, clothes washers, dishwashers, and ceiling fans use 15%, 25%, 40%, and 50% less electricity than standard appliances, respectively. For ceiling fans, the 50% reduction was applied to 84.1 kWh of the electricity attributed to the Miscellaneous RASS category.

Abbreviations:

BARBD - Building America Research Benchmark Definition
CEC - California Energy Commission
NREL - National Renewable Energy Laboratory
RASS - Residential Appliance Saturation Survey
USEPA - United States Environmental Protection Agency

Sources:

CEC. 2004. Residential Appliance Saturation Survey. Available online at: http://www.energy.ca.gov/appliances/rass/

NREL. 2010. Building America Research Benchmark Definition. Available online at: http://www.nrel.gov/docs/fy10osti/47246.pdf

USEPA. 2008. ENERGY STAR 2008 Annual Report. Available online at: http://www.epa.gov/cpd/annualreports/annualreports.htm

2.1.5 Install Energy Efficient Boilers

Range of Effectiveness: 1.2-18.4% of boiler GHG emissions

Measure Description:

Boilers are used in many non-residential and multi-family housing buildings to provide space heating or steam or facility operations. Boilers combust natural gas to produce steam which can be used directly or as a method to heat a building space. Boilers represent 12% of installed building heating equipment for commercial and other buildings. Boiler efficiencies are regulated and commonly presented as annualized fuel utilization efficiency (AFUE), a ratio of the total useful heat delivered to the heat value from the annual amount of fuel consumed. Improving boiler efficiency decreases natural gas consumption for the same amount of energy output, thus reducing GHG emissions.

Only natural gas boilers are considered under this mitigation measure. The Project Applicant would only need to provide the annual natural gas consumptions to calculate the baseline emissions using heat content and carbon intensity factors from CCAR [3]. To determine the emission reduction, boiler efficiency is also needed, and should be obtainable from manufacturer specifications. The Consortium for Energy Efficiency (CEE) reports that the rate of high efficiency boilers (≥ 85%) has gone from 5-15% of sales in 2002 to 50%-60% of sales in 2007 [2]. The CEE study also noted that technical improvements can be made to existing boiler types to improve efficiency to 88%. Efficiency can be further enhanced to up to 98% using the condensing boiler.

A range of efficiencies from the CEE study has been presented for reference, but to take credit for this mitigation measure, the Project Applicant would also need to provide evidence from manufacturers supporting the higher efficiency from a retrofit or new boiler.

Measure Applicability:

- Natural Gas Boilers

Inputs:

The following information needs to be provided by the Project Applicant:

- Natural gas consumption of boiler
- Original or baseline efficiency of boiler
- Improved efficiency of boiler

Baseline Method:

$$\text{Emission} = \text{Consumption} \times HC \times EF \times C$$

Where:

Emission = MT CO_2e
Consumption = Natural gas consumption (ft^3)
HC = Natural gas heat content = 1,029 BTU/ft^3 (CCAR 2009)
EF = Natural gas carbon intensity factor = 0.1173 lbs CO_2e/kBTU (CCAR 2009)
C = Unit conversion factor
In this case, C = 4.54×10^{-7} kBTU x MT/BTU/lbs

Mitigation Method:

The GHG emission from a boiler with improved efficiency is:

$$\text{Mitigated GHG Emission} = \text{Consumption} \times \frac{E_O}{E_I} \times HC \times EF \times C$$

Where:

Emission = MT CO_2e
Consumption = Natural gas consumption (ft^3)
E_O = Original efficiency of boiler
E_I = Improved efficiency of boiler
HC = Natural gas heat content = 1,029 BTU/ft^3 (CCAR 2009)
EF = Natural gas carbon intensity factor = 0.1173 lbs CO_2e/kBTU (CCAR 2009)
C = Unit conversion factor

Emission Reduction Ranges and Variables:

Percentage of emissions reduction using a boiler with improved efficiency for all pollutants are the same and is calculated as follows:

$$\text{Reduction} = 1 - \frac{E_O}{E_I}$$

Where:

E_O = Original efficiency of boiler
E_I = Improved efficiency of boiler

Technology	Range of Efficiencies	Range of Emission Reduction
Atmospheric	80 – 84%	-
Fan assisted, non-condensing	85 – 88%	1.2% – 9.1%
Fan assisted, condensing	88 – 98%	4.5% – 18.4%

Discussion:

Boiler efficiency is included in product specification from manufacturer. ENERGY STAR boilers require minimum efficiency of 85%. The Consortium for Energy Efficiency (CEE) reports natural efficiency breakpoints of 85-88% for fan assisted, non-condensing commercial boilers, and 88-98% for fan assisted, condensing boilers.

Assumptions:

Data based upon the following references:

- California Climate Action Registry 2009. General Reporting Protocol, Version 3.1. Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
- Energy Star. Boilers key Product Criteria. Available at: http://www.energystar.gov/index.cfm?c=boilers.pr_crit_boilers
- Science Applications International Corporation 2009. Prepared for California Climate Action Registry. Development of Issue Papers for GHG Reduction Project Types: Boiler Efficiency Projects. Available at: http://www.climateactionreserve.org/wp-content/uploads/2009/03/future-protocol-development_boiler-efficiency.pdf

Preferred Literature:

Boilers represent 12% of installed building heating equipment. Boiler efficiencies are regulated and commonly presented as annualized fuel utilization efficiency (AFUE), a ratio of the total useful heat delivered to the heat value from the annual amount of fuel consumed. The Climate Action Registry (CAR) Boiler Efficiency Projects estimated potential annual CO_2e emission reductions of 22,673,929 and 6,584,231 MT for commercial and residential boilers, respectively, from boiler efficiency improvement from 77% to 83% [1]. The Consortium for Energy Efficiency (CEE) reports that the rate of high efficiency boilers (≥ 85%) has gone from 5-15% of sales in 2002 to 50%-60% of sales in 2007 [2]. The CEE study also noted that technical improvements can be made to existing boiler types to improve efficiency to 88%. Efficiency can be further enhanced to up to 98% using the condensing boiler.

Only natural gas boilers are considered under this mitigation measure. The Project Applicant would only need to provide the annual natural gas consumptions to calculate the baseline emissions using heat content and carbon intensity factors from CCAR [3]. To determine the emission reduction, boiler efficiency is also needed, and should be obtainable from manufacturer specifications. A range of efficiencies from the CEE study has been presented for reference, but to take credit for this mitigation measure, the Project Applicant would also need to provide evidence from manufacturers supporting the higher efficiency from a retrofit or new boiler.

Alternative Literature:

None

Notes:

[1] Science Applications International Corporation 2009. Prepared for Climate Action Registry (CAR). Development of Issue Papers for GHG Reduction Project Types: Boiler Efficiency Projects. Available at: http://www.climateactionreserve.org/wp-content/uploads/2009/03/future-protocol-development_boiler-efficiency.pdf

[2] Consortium of Energy Efficiency (CEE) Winter Program Meeting 2008. Market Characterization of Commercial Gas Boilers.

[3] CCAR 2009. General Reporting Protocol, Version 3.1. Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

Other Literature Reviewed:

None

2.2 Lighting

2.2.1 Install Higher Efficacy Public Street and Area Lighting

Range of Effectiveness:

16-40% of outdoor lighting

Measure Description:

Lighting sources contribute to GHG emissions indirectly, via the production of the electricity that powers these lights. Public street and area lighting includes streetlights, pedestrian pathway lights, area lighting for parks and parking lots, and outdoor lighting around public buildings. Lighting design should consider the amount of light required for the area intended to be lit. Lumens are the measure of the amount of light perceived by the human eye. Different light fixtures have different efficacies or the amount of lumens produced per watt of power supplied. This is different than efficiency, and it is important that lighting improvements are based on maintaining the appropriate lumens per area when applying this measure. Installing more efficacious lamps will use less electricity while producing the same amount of light, and therefore reduces the associated indirect GHG emissions.

Measure Applicability:

- Public street and area lighting

Inputs:

The following information needs to be provided by the Project Applicant:

- Number of lighting heads (for baseline only)
- Power rating of public street and area lights
- Carbon intensity of local utility (for baseline only)

Baseline Method:

$$\text{GHG emissions} = \text{Heads} \times \text{Hours} \times \text{Days} \times \text{Power}_{baseline} \times \text{Utility}$$

Where:

GHG emissions	=	MT CO_2e/yr
Heads	=	Number of public street and area lighting heads. Provided by Applicant.
Hours	=	Hours of operation per day (12).
Days	=	Days of operation per year (365).
$\text{Power}_{baseline}$	=	Power rating of public street and area lights (kW).
Utility	=	Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

The minimum reduction in annual energy cost associated with higher efficacy street lighting systems is 16%. Note that a 16% reduction in power rating and GHG emissions is the estimated minimum percent reduction associated with installing higher efficacy public street and area lighting. NYSERDA reports that a 16% reduction is expected for installing metal halide post top lights as opposed to typical mercury cobrahead lights. The percent reduction is expected to increase to 35% for installing metal halide cobrahead or metal halide cutoff lights, and 40% for installing high pressure sodium cutoff lights. For lights operating with a single local utility district, the 16% energy cost reduction is equivalent to a 16% reduction in power rating because the energy cost comparison assumes an equal number of lighting heads and equal operation times. As all other variables remain equal between the baseline and mitigated scenarios, the reduction in GHG emissions is in turn 16%. Therefore, the reduction in GHG emissions associated with installing higher efficacy public street and area lighting is:

$$\text{GHG emission reduction} = \frac{Power_{baseline} - Power_{mitigated}}{Power_{baseline}} = 16\%$$

Where:

GHG emission reduction	=	Percentage reduction in GHG emissions for public street and area lighting.
$Power_{baseline}$	=	Power rating of public street and area lights (kW).
$Power_{mitigated}$	=	Power rating of public street and area lights (kW).

If different types of lampheads result in less heads needing to be installed, the reduction will be as follows:

$$\frac{Head_{baseline} \times Power_{baseline} - Head_{mitigated} \times Power_{mitigated}}{Head_{baseline} \times Power_{baseline}}$$

Where:

$Head_{baseline}$	=	the number of heads in the baseline scenario
$Power_{baseline}$	=	the number of heads in the mitigated scenario

As it can be seen by this equation, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Note that a 16% reduction in power rating and GHG emissions is the estimated minimum percent reduction associated with installing higher efficacy public street and area lighting. NYSERDA reports that a 16% reduction is expected for installing metal halide post top lights as opposed to typical mercury cobrahead lights. The percent reduction is expected to increase to 35% for installing metal halide cobrahead or metal halide cutoff lights, and 40% for installing high pressure sodium cutoff lights.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	16% for installing metal halide post top lights; 35% for installing metal halide cobrahead or cutoff lights; 40% for installing high pressure sodium cutoff lights
All other pollutants	Not Quantified[16]

Discussion:

If the applicant uses public street and area lighting, they would calculate baseline emissions as described in the baseline methodologies section. If the applicant then selects to mitigate public street and area lighting by committing to higher efficacy options, the applicant would reduce the amount of GHG emissions associated with public street and area lighting by 16%.

GHG Emissions Reduced = 16%

Assumptions:

Data based upon the following reference:

[1] New York State Energy Research and Development Authority (NYSERDA). 2002. NYSERDA How-to Guide to Effective Energy-Efficient Street Lighting for Municipal Elected/Appointed Officials.

Preferred Literature:

The New York State Energy Research and Development Authority (NYSERDA)'s 2002 How-to Guide to Effective Energy-Efficient Street Lighting reports a minimum reduction in electricity demand of 16% due to the installation of energy-efficient street lights such as metal halide and high-pressure sodium models (see page 4).

Alternative Literature:

None

Other Literature Reviewed:

[16] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

[2] The University of Rochester. Light-Emitting Diode (LED), Organic Light-Emitting Diode (OLED), and laser research for lighting applications. Homepage available online at: http://www.rochester.edu/research/sciences.html. Accessed February 2010.

[3] Chittenden County Regional Planning Commission. 1996. Outdoor Lighting Manual for Vermont Municipalities.

2.2.2 Limit Outdoor Lighting Requirements

Range of Effectiveness:

Best Management Practice, but may be quantified.

Measure Description:

Lighting sources contribute to GHG emissions indirectly, via the production of the electricity that powers these lights. When the operational hours of a light are reduced, GHG emissions are reduced. Strategies for reducing the operational hours of lights include programming lights in public facilities (parks, swimming pools, or recreational centers) to turn off after-hours, or installing motion sensors on pedestrian pathways. Since literature guidance for quantifying these reductions does not exist, this mitigation measure would be employed as a Best Management Practice. In order to take credit for this mitigation measure, the Project Applicant would need to provide detailed and substantial documentation of the reduction in operational hours of lights.

Measure Applicability:

- Outdoor lighting
- Best Management Practice unless Project Applicant supplies substantial evidence.

Inputs:

The following information needs to be provided by the Project Applicant:

- Number of outdoor lights
- Power rating of outdoor lights
- Carbon intensity of local utility (for baseline only)
- Limited hours of operation of outdoor lights

Baseline Method:

$$\text{GHG emissions} = \text{Heads} \times \text{Hours} \times \text{Power}_{baseline} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e/yr

Heads = Number of outdoor lighting heads. Provided by Applicant.

Hours = Annual hours of operation (4,280)[17].

$\text{Power}_{baseline}$ = Power rating of outdoor lights (kW).

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

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[17] Estimated based on the annual number of dark hours (hours between sunset and sunrise) for Los Angeles, California.

Mitigation Method:

Limiting the hours of operation of outdoor lights in turn limits the indirect GHG emissions associated with their electricity usage. Therefore, the reduction in GHG emissions associated with limiting outdoor lighting is:

$$\text{GHG emission reduction} = \frac{\text{Hours}_{\text{baseline}} - \text{Hours}_{\text{limited}}}{\text{Hours}_{\text{baseline}}}$$

Where:

GHG emission reduction	=	Percentage reduction in GHG emissions for outdoor lighting.
$\text{Hours}_{\text{baseline}}$	=	Annual hours of operation (4,280).
$\text{Hours}_{\text{limited}}$	=	Limited hours of operation per day. Provided by Applicant.

As it can be seen by this equation, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

This is a best management practice measure unless the Project Applicant supplies substantial evidence justifying a reduction in hours of operation. Check with local agencies for guidance on any allowed reductions associated with implementation of best management practices.

Pollutant	Category Emissions Reductions
CO_2e	0 to 100%
All other pollutants	Not Quantified[18]

Discussion:

If the applicant uses outdoor lighting, they would calculate baseline emissions as described in the baseline methodologies document. If the applicant then selects to mitigate outdoor lighting by limiting operation to 10 hours per day, the applicant would reduce the amount of GHG emissions associated with outdoor lighting by 20%.

$$\text{GHG Emissions Reduced} = \frac{12-10}{10} = 0.20 \text{ or } 20\%$$

Assumptions:

[18] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

None

Preferred Literature:

None

Other Literature Reviewed:

None

2.2.3 Replace Traffic Lights with LED Traffic Lights

Range of Effectiveness:

90% of emissions associated with existing traffic lights.

Measure Description:

Lighting sources contribute to GHG emissions indirectly, via the production of the electricity that powers these lights. Installing higher efficiency traffic lights reduces energy demand and associated GHG emissions. As high efficiency light-emitting diodes (LEDs), which consume about 90% less energy than traditional incandescent traffic lights while still providing adequate light or lumens when viewed, are currently required to meet minimum federal efficiency standards for new traffic lights. Project Applicants may take credit only if they are retrofitting existing incandescent traffic lights.

Measure Applicability:

- Traffic lighting – retrofitting incandescent traffic lights

Inputs:

The following information needs to be provided by the Project Applicant:

- Number of incandescent traffic lights being retrofitted
- Power rating of incandescent traffic lights being retrofitted
- Carbon intensity of local utility (for baseline only)

Baseline Method:

$$\text{GHG emissions} = \text{Lights x Hours x Days x Power}_{\text{baseline}} \text{ x Utility}$$

Where:

GHG emissions = MT CO_2e/yr

Lights = Number of incandescent traffic lights being retrofitted. Provided by Applicant.

Hours = Hours of operation per day (24).

Days = Days of operation per year (365).

$Power_{baseline}$ = Power rating of incandescent traffic lights being retrofitted (kW).

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

Traffic lights using LEDs consume about 90% less power than traditional incandescent traffic lights. Therefore, the reduction in GHG emissions associated with replacing incandescent traffic lights with LED-based traffic lights is:

$$\text{GHG emission reduction} = \frac{\text{Power}_{baseline} - \text{Power}_{mitigated}}{\text{Power}_{baseline}} = 90\%$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for traffic lighting.
$\text{Power}_{baseline}$ = Power rating of incandescent traffic lights (kW).
$\text{Power}_{mitigated}$ = Power rating of LED traffic lights (kW).

As it can be seen by this equation, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	90%
All other pollutants	Not Quantified[19]

Discussion:

If the applicant uses traffic lights, they would calculate baseline emissions as described in the baseline methodologies document. If the applicant then selects to mitigate traffic lights by committing to replacing all existing incandescent traffic lights with LED traffic lights, the applicant would reduce the amount of GHG emissions associated with traffic lights in an existing area by 90%.

GHG Emissions Reduced = 90%

Assumptions:

Data based upon the following references:

[1] USDOE. 2004. NREL. State Energy Program Case Studies: California Says “Go” to Energy-Saving Traffic Lights. Available online at: http://www.nrel.gov/docs/fy04osti/35551.pdf

[2] USEPA. ENERGY STAR: Traffic Signals. Available online at: http://www.energystar.gov/index.cfm?c=traffic.pr_traffic_signals. Accessed February 2010.

[19] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

Preferred Literature:

NREL reports that traffic lights based on light-emitting diodes (LEDs) consume about 90% less power than traditional incandescent traffic lights. All traffic lights manufactured on or after January 1, 2006 must meet minimum federal efficiency standards, which are consistent with ENERGY STAR specifications for LED traffic lights.

Alternative Literature:

None

Other Literature Reviewed:

[3] The University of Rochester. LED, OLED, and laser research for lighting applications. Homepage available online at: http://www.rochester.edu/research/sciences.html. Accessed February 2010.

2.3 Alternative Energy Generation

2.3.1 Establish Onsite Renewable or Carbon-Neutral Energy Systems-Generic

Range of Effectiveness:

0-100% of emissions associated with electricity use. Note some systems could increase energy use.

Measure Description:

Using electricity generated from renewable or carbon-neutral power systems displaces electricity demand which would ordinarily be supplied by the local utility. Different sources of electricity generation that local utilities use have varying carbon intensities. Renewable energy systems such as fuel cells may have GHG emissions associated with them. Carbon-neutral power systems, such as photovoltaic panels, do not emit GHGs and will be less carbon intense than the local utility. This mitigation measure describes a method to calculate GHG emission reductions from displacing utility electricity with electricity generated from an on-site power system, which may incorporate technology which has not yet been established at the time this document was written.

Measure Applicability:

- Electricity use

Inputs:

The following information needs to be provided by the Project Applicant:

- Total annual electricity demand (kWh)
- Annual amount of electricity to be provided by the on-site power system (kWh) or percent of total electricity demand to be provided by the on-site power system (%)
- Carbon intensity of local utility and on-site power system if not carbon neutral

Baseline Method:

$$\text{GHG emissions} = \text{Electricity}_{\text{baseline}} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$\text{Electricity}_{\text{baseline}}$ = Total electricity demand (kWh) Provided by Applicant

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

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Mitigation Method:

If the total amount of electricity to be provided by the carbon-neutral power system is known, then the GHG emission reduction is equivalent to the ratio of electricity from the carbon-neutral power system to the total electricity demand:

$$\text{GHG emission reduction} = \frac{\text{Electricity}_{\text{carbon-neutral}}}{\text{Electricity}_{\text{baseline}}}$$

Where:

GHG emission reduction	=	Percentage reduction in GHG emissions for electricity use
$\text{Electricity}_{\text{carbon-neutral}}$	=	Electricity to be provided by the carbon-neutral power system (kWh)
$\text{Electricity}_{\text{baseline}}$	=	Total electricity demand (kWh)

If the percent of total electricity demand to be provided by the carbon-neutral power system is known, then the GHG emission reduction is equivalent to that percentage.

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions for carbon neutral systems.

If the total amount of electricity to be provided by a renewable energy system that is not carbon neutral, then the GHG emission reduction is equivalent to the following equation:

$$\text{GHG emission reduction} = \frac{\text{Electricity}_{\text{renewable}}}{\text{Electricity}_{\text{baseline}}} \times \frac{(\text{Utility} - \text{Renewable})}{\text{Utility}}$$

Where

$\text{Electricity}_{\text{renewable}}$ = Electricity provided by renewable power system (kWh)

Renewable = Carbon intensity of renewable system (CO_2e/kWh)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Up to 100%, assuming all electricity demand is provided by a carbon-neutral power system
All other pollutants	Not Quantified[20],[21]

Discussion:

[20] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.
[21] Assumes that the onsite carbon-neutral system displaces electricity use only.

If a project's total electricity demand is 10,000 kWh, and 1,000 kWh of that is provided by the carbon-neutral system, then the GHG emission reduction is 10%

$$\text{GHG Emission Reduced} = \frac{1{,}000}{10{,}000} = 0.10 \text{ or } 10\%$$

If a project instead uses a renewable system with carbon intensity of 500 CO_2e/kWh and the local utility is 100 CO_2e/kWh, then the GHG emission reduction is 5%.

$$\text{GHG Emission Reduced} = \frac{1{,}000}{10{,}000} \times \frac{(1{,}000 - 500)}{1{,}000} = 0.05 \text{ or } 5\%$$

2.3.2 Establish Onsite Renewable Energy Systems-Solar Power

Range of Effectiveness: 0-100% of GHG emissions associated with electricity use.

Measure Description:

Using electricity generated from photovoltaic (PV) systems displaces electricity demand which would ordinarily be supplied by the local utility. Since zero GHG emissions are associated with electricity generation from PV systems[22], the GHG emissions reductions from this mitigation measure are equivalent to the emissions that would have been produced had electricity been supplied by the local utility.

Measure Applicability:

- Electricity use

Inputs:

The following information needs to be provided by the Project Applicant:

- Total electricity demand (kWh)
- Amount of electricity to be provided by the PV system (kWh) or percent of total electricity demand to be provided by the PV system (%)

Baseline Method:

$$\text{GHG emissions} = \text{Electricity}_{\text{baseline}} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$\text{Electricity}_{\text{baseline}}$ = Total electricity demand (kWh) Provided by Applicant

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

If the total amount of electricity to be provided by the PV system is known, then the GHG emission reduction is equivalent to the ratio of electricity from the PV system to the total electricity demand:

$$\text{GHG emission reduction} = \frac{\text{Electricity}_{\text{PV}}}{\text{Electricity}_{\text{baseline}}}$$

[22] This mitigation measure does not account for GHG emissions associated with the embodied energy of PV systems.

Where:

GHG emission reduction	=	Percentage reduction in GHG emissions for electricity use
$Electricity_{PV}$	=	Electricity to be provided by PV system (kWh)
$Electricity_{baseline}$	=	Total electricity demand (kWh)

If the percent of total electricity demand to be provided by the PV system is known, then the GHG emission reduction is equivalent to that percentage.

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

The amount of electricity generated by a PV system depends on the size and type of the PV system and the location of the project. The Project Applicant can use a publically-available solar calculator, such as California's Public Utilities and Energy Commissions Go Solar Clean Power Estimator[23], to estimate the size of the PV system needed to generate the desired amount of electricity. The only input required for this calculator is the location (zip code). Estimates of the amount of electricity that can be generated from 1.5, 3, 5, and 10 kW PV systems in cities around California are shown in Table AE-2.1 below.

Since there is a range of PV system efficiencies, the local agency may consider checking the type of PV efficiency assumed to ensure the system that is installed meets this capacity.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Up to 100%, assuming all electricity demand is provided by a PV system. Percent reduction would scale down linearly as the percent of electricity provided by a PV system decreases.
All other pollutants	Not Quantified[24]

Discussion:

If a project's total electricity demand is 10,000 kWh, and 1,000 kWh of that is provided by a PV system, then the GHG emission reduction is 10%

[23] Available online at http://gosolarcalifornia.cleanpowerestimator.com/gosolarcalifornia.htm.
[24] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

$$\text{GHG Emission Reduced} = \frac{1{,}000}{10{,}000} = 0.10 \text{ or } 10\%$$

Assumptions:

The data in Table AE-2.1 was generated from California's Public Utilities and Energy Commissions Go Solar Clean Power Estimator, a publically-available solar calculator which the Project Applicant can use to estimate the PV system size needed to generate the desired amount of electricity. It is available online at: http://gosolarcalifornia.cleanpowerestimator.com/gosolarcalifornia.htm.

Other publically-available solar calculators include:

- USDOE. NREL: PVWatts Calculator. Available online at: http://www.nrel.gov/rredc/pvwatts/.
- SolarEstimate.Org. Solar & Wind Estimator. Available online at: http://www.solar-estimate.org/index.php?page=solar-calculator.
- SharpUSA. Solar Calculator. Available online at: http://sharpusa.cleanpowerestimator.com/sharpusa.htm.

Preferred Literature:

None

Other Literature Reviewed:

None

Table AE-2.1
Estimated Electricity Generation from Typical PV Systems

Location			Annual kWh Generated		
Air District	**Major City**	**Zip Code**	**3 kW PV System**	**5 kW PV System**	**10 kW PV System**
Amador County	Ione	95640	4,857	8,094	16,189
Antelope Valley	Lancaster	93534	5,034	8,390	16,781
Bay Area	San Francisco	94101	4,926	8,218	16,436
Butte County	Chico	95926	4,857	8,094	16,189
Calaveras County	Rancho Calaveras	95252	4,857	8,094	16,189
Colusa County	Colusa	95932	4,857	8,094	16,189
El Dorado County	South Lake Tahoe	96150	5,275	8,792	17,584
Feather River	Yuba City	95991	4,857	8,094	16,189
Glenn County	Orland	95963	4,857	8,094	16,189
Great Basin Unified	Bishop	93514	5,507	9,179	18,358
Imperial County	El Centro	92243	5,117	8,528	17,056
Kern County	Bakersfield	93301	5,082	8,470	16,939
Lake County	Lakeport	95453	4,857	8,094	16,189
Lassen County	Susanville	96130	5,275	8,792	17,584
Mariposa County	Mariposa	95338	5,065	8,441	16,882
Mendocino County	Ukiah	95482	4,926	8,218	16,436
Modoc County	Alturas	96101	5,275	8,792	17,584
Mojave Desert	Victorville	92392	5,885	9,808	19,617
Monterey Bay Unified	Monterey	93940	4,926	8,218	16,436
North Coast Unified	Eureka	95501	4,081	6,801	13,602
Northern Sierra	Grass Valley	95949	4,857	8,094	16,189
Northern Sonoma County	Healdsburg	95448	4,931	8,218	16,436
Placer County	Roseville	95678	4,857	8,094	16,189
Sacramento Metro	Sacramento	95864	4,857	8,094	16,189
San Diego County	San Diego	92182	5,102	8,528	17,056
San Joaquin Valley Unified	Fresno	93650	5,065	8,441	16,882
San Luis Obispo County	San Luis Obispo	93405	5,320	8,932	17,865
Santa Barbara County	Santa Barbara	93101	5,320	8,932	17,865
Shasta County	Redding	96001	4,081	6,801	13,602
Siskiyou County	Yreka	96097	4,363	7,271	14,543
South Coast	Los Angeles	90071	5,034	8,390	16,781
Tehama County	Red Bluff	96080	4,857	8,094	16,189
Tuolumne County	Sonora	95370	4,857	8,094	16,189
Ventura County	Oxnard	93030	5,034	8,390	16,781
Yolo-Solano	Davis	95616	4,857	8,094	16,189

2.3.3 Establish Onsite Renewable Energy Systems-Wind Power

Range of Effectiveness: 0-100% of GHG emissions associated with electricity use.

Measure Description:

Using electricity generated from wind power systems displaces electricity demand which would ordinarily be supplied by the local utility. Since zero GHG emissions are associated with electricity generation from wind turbines[25], the GHG emissions reductions from this mitigation measure are equivalent to the emissions that would have been produced had electricity been supplied by the local utility.

Measure Applicability:

- Electricity use

Inputs:

The following information needs to be provided by the Project Applicant:

- Total electricity demand (kWh)
- Amount of electricity to be provided by the wind power system (kWh) or percent of total electricity demand to be provided by the wind power system (%)

Baseline Method:

$$\text{GHG emissions} = \text{Electricity}_{baseline} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$\text{Electricity}_{baseline}$ = Total electricity demand (kWh) Provided by Applicant

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

The GHG emission reduction is equivalent to the ratio of electricity from the wind power system to the total electricity demand:

$$\text{GHG emission reduction} = \frac{\text{Electricity}_{wind}}{\text{Electricity}_{baseline}}$$

[25] This mitigation measure does not account for GHG emissions associated with the embodied energy of wind turbines.

Where:

GHG emission reduction	=	Percentage reduction in GHG emissions for electricity use
$Electricity_{wind}$	=	Electricity to be provided by wind power system (kWh)
$Electricity_{baseline}$	=	Total electricity demand (kWh)

If the percent of total electricity demand to be provided by the wind power system is known, then the GHG emission reduction is equivalent to that percentage.

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Up to 100%, assuming all electricity demand is provided by a wind power system. Percent reduction would scale down linearly as the percent of electricity provided by a wind power system decreases.
All other pollutants	None[26]

Discussion:

If a project's total electricity demand is 10,000 kWh, and 1,000 kWh of that is provided by a wind system, then the GHG emission reduction is 10%

$$\text{GHG Emission Reduced} = \frac{1{,}000}{10{,}000} = 0.10 \text{ or } 10\%$$

Assumptions:

None

Preferred Literature:

None

[26] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

Other Literature Reviewed:

None

2.3.4 Utilize a Combined Heat and Power System

Range of Effectiveness: 0-46% of GHG emissions associated with electricity use.

Measure Description:

For the same level of power output, combined heat and power (CHP) systems utilize less input energy than traditional separate heat and power (SHP) generation, resulting in fewer CO_2 emissions. In traditional SHP systems, heat created as a by-product is wasted by being released into the environment. In contrast, CHP systems harvest the thermal energy and use it to heat onsite or nearby processes, thus reducing the amount of natural gas or other fuel that would otherwise need to be combusted to heat those processes. In addition CHP systems lower the demand for grid electricity, thereby displacing the CO_2 emissions associated with the production of grid electricity.

This mitigation measure describes how to estimate CO_2 emissions savings (in MT per year) from utilizing a CHP system to supply energy demands which would otherwise be provided by separate heat and power systems (e.g. grid electricity for electricity demand and boilers for thermal demand). CO_2 emissions savings are quantified using the USEPA CHP Emission Calculator which allows users to estimate the CO_2 emissions savings associated with displaced electricity and thermal production from five CHP technologies: microturbine, fuel cell, reciprocating engine, combustion turbine, and backpressure steam turbine. The first three technologies have electricity generation capacities on a scale appropriate for residential neighborhoods, planned communities, and mixed-use and commercial developments. Combustion turbines and backpressure steam turbines are more appropriate for industrial processes or very large commercial developments. The user has the option to input project-specific data such as specific fuels, duct burner operation, cooling demand, and boiler efficiencies.

Table AE-4.1 provides examples of expected CO_2 savings for microturbines, fuel cells, and reciprocating engines of a range of electricity generating capacities for the five major California utilities (Southern California Edison (SCE), Los Angeles Department of Water and Power (LADWP), San Diego Gas and Electric (SDGE), Pacific Gas and Electric (PGE), and the Sacramento Municipal Utility District (SMUD). Default values provided by the USEPA CHP Calculator were used wherever possible (see the Assumptions section below). The magnitude of CO_2 reductions depends on the baseline power sources. For thermal demand, the baseline is assumed to be a new boiler with 80% efficiency. For electricity demand, the baseline is the carbon intensity of the local utility, which varies by utility. For reference, Table AE-4.2 provides the 2006 carbon intensity of delivered electricity for the five utilities. As shown in Table AE-4.1, certain CHP systems may not be appropriate for certain locations, especially in Northern California where PGE and SMUD have relatively low carbon intensities.

Measure Applicability:

- Grid electricity use
- Natural gas combustion

Inputs:

The following information needs to be provided by the Project Applicant:

- Expected CHP technology (microturbine, fuel cell, or reciprocating engine)
- Expected electricity demand

Baseline Method:

GHG emissions = CO_2 emissions displaced

Where:

GHG emissions	=	MT CO_2e
CO_2 emissions displaced	=	MT CO_2 from separate heat and power system Provided in Table AE-4.1 or calculated using USEPA CHP Calculator

Here it is assumed that all GHG emissions produced from fuel combustion and electricity generation are CO_2 emissions.

Mitigation Method:

GHG emission reduction = Percent Reduction in CO_2 emissions

Provided in Table A E-4.1 or calculated using USEPA CHP Calculator

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Up to 100%, assuming all electricity demand is provided by a CHP system. Percent reduction would scale down linearly as the percent of electricity provided by a CHP system decreases.
All other pollutants	0-70%[27] Depends on CHP technology, electricity generating capacity, sulfur content of fuel, and displaced thermal generation technology. Reductions in CO_2 may produce increases in SO_2 and/or NOx, or vice versa.

[27] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

Discussion:

Assume a project is located in SCE's service area and has an expected electricity demand of 100 kW. Using Table AE-4:

- A 100 kW microturbine will generate more CO_2 emissions than a separate heat and power system of equivalent power capacity.
- A 100 kW fuel cell will generate about the same CO_2 emissions than a separate heat and power system of equivalent power capacity.
- A 100 kW reciprocating engine will generate 14% less CO_2 emissions as a separate heat and power system of equivalent power capacity.

Therefore, the Project Applicant should choose the reciprocating engine. This system would generate 568 MT CO_2 compared to 657 MT CO_2 from the separate heat and power system.

Assumptions:

Table AE-4.1 was prepared using the 2009 USEPA CHP Calculator, a publically-available tool found online at: http://www.epa.gov/chp/basic/calculator.html. The following defaults and assumptions were made to generate the data in Table AE-4.1:

- The range of electricity generating capacity shown in Table AE-4.1 is based on the normal range for the technology (as per Calculator default)
- Operates 8,760 hours per year
- Provides heat only (no cooling)
- Combusts natural gas fuel (116.7 CO_2/MMBtu emission rate and 1,020 Btu/scf HHV as per Calculator defaults)
- No supplementary duct burner
- Assumes 8% transmission loss for displaced electricity

Table AE-4.2 was prepared using data from the California Climate Action Registry (CCAR) Power/Utility Protocol (PUP) public reports for reporting year 2006. These PUP reports are available online at:
https://www.climateregistry.org/CARROT/public/reports.aspx.

Preferred Literature:

The USEPA CHP Emissions Calculator compares the anticipated emissions from a CHP system to the emissions from SHP systems. The Calculator was developed by the U.S. Department of Energy's Distributed Energy Program, Oak Ridge National Laboratory, and the U.S. Environmental Protection Agency's CHP Partnership. Users can choose from five different CHP technologies (microturbine, fuel cell, reciprocating engine, combustion turbine, and backpressure steam turbine) and compare their performance to a number of different SHP systems (e.g. local electricity utility and existing or new gas boiler, fuel oil boiler, or heat bump). Additionally, users have the option to refine the analysis with project-specific inputs such as the cooling demand and additional duct burning. Details such as the cooling efficiency of the displaced cooling system must be known to perform more detailed analysis. The calculator can be used to estimate expected reductions in CO_2, SO_2, and NOx emissions as well as fuel usage.

Alternative Literature:

The USEPA Combined Heat and Power Partnership Catalog of CHP Technologies presents performance details of six CHP technologies: gas turbine, microturbine, spark and compression ignition reciprocating engines, steam turbine, and fuel cell. Table I of the Introduction presents the equations necessary to calculate the percent fuel savings from using a CHP system instead of traditional separate heat and power generation. Subsequent chapters describe performance details of each of the CHP technologies, including estimated CO_2 emissions. The GHG emissions reductions associated with this mitigation measure are the change in emissions from using a CHP system rather than a SHP system in a building. The USEPA CHP Calculator methodologies are based in part on this Catalog of CHP Technologies document.

Other Literature Reviewed:

None

Table AE-4.1
Estimated CO_2 Emissions Savings from CHP Systems in California[1,2]

Utility	CHP Technology	Electricity Generating Capacity	Electric Efficiency	Power to Heat Ratio	CO_2 Emissions from CHP	CO_2 Emissions Displaced	Percent Reduction in CO_2 Emissions[3]
		(kW)	(% HHV)	--	(MT/year)	(MT/year)	(%)
SCE	Microturbine	30	24%	0.51	200	200	0%
		50	24%	0.51	334	333	0%
		100	26%	0.7	607	559	-9%
		250	26%	0.92	1517	1229	-23%
	Fuel Cell	5	30%	0.79	26	26	0%
		100	30%	0.79	527	527	0%
		1000	43%	1.95	3679	3783	3%
		2000	46%	1.92	6884	7597	9%
	Reciprocating Engine (Rich Burn)	55	30%	0.63	290	325	11%
		100	28%	0.52	568	657	14%
		1000	29%	0.64	5514	5859	6%
		1200	28%	0.63	6759	7052	4%
LADWP	Microturbine	30	24%	0.51	200	277	28%
		50	24%	0.51	334	462	28%
		100	26%	0.7	607	817	26%
		250	26%	0.92	1517	1875	19%
	Fuel Cell	5	30%	0.79	26	39	33%
		100	30%	0.79	527	786	33%
		1000	43%	1.95	3679	6366	42%
		2000	46%	1.92	6884	12762	46%
	Reciprocating Engine (Rich Burn)	55	30%	0.63	290	466	38%
		100	28%	0.52	568	915	38%
		1000	29%	0.64	5514	8441	35%
		1200	28%	0.63	6759	10188	34%
SDGE	Microturbine	30	24%	0.51	200	218	8%
		50	24%	0.51	334	363	8%
		100	26%	0.7	607	620	2%
		250	26%	0.92	1517	1381	-10%
	Fuel Cell	5	30%	0.79	26	30	12%
		100	30%	0.79	527	588	10%
		1000	43%	1.95	3679	4387	16%
		2000	46%	1.92	6884	8806	22%

Utility	CHP Technology	Electricity Generating Capacity	Electric Efficiency	Power to Heat Ratio	CO_2 Emissions from CHP	CO_2 Emissions Displaced	Percent Reduction in CO_2 Emissions[3]
		(kW)	(% HHV)	--	(MT/year)	(MT/year)	(%)
	Reciprocating Engine (Rich Burn)	55	30%	0.63	290	358	19%
		100	28%	0.52	568	717	21%
		1000	29%	0.64	5514	6463	15%
		1200	28%	0.63	6759	7814	14%
PGE	Microturbine	30	24%	0.51	200	175	-15%
		50	24%	0.51	334	293	-14%
		100	26%	0.7	607	479	-27%
		250	26%	0.92	1517	1030	-47%
	Fuel Cell	5	30%	0.79	26	23	-16%
		100	30%	0.79	527	447	-18%
		1000	43%	1.95	3679	2984	-23%
		2000	46%	1.92	6884	5999	-15%
	Reciprocating Engine (Rich Burn)	55	30%	0.63	290	280	-4%
		100	28%	0.52	568	577	2%
		1000	29%	0.64	5514	5059	-9%
		1200	28%	0.63	6759	6130	-10%
SMUD	Microturbine	30	24%	0.51	200	188	-7%
		50	24%	0.51	334	314	-6%
		100	26%	0.7	607	522	-16%
		250	26%	0.92	1517	1137	-33%
	Fuel Cell	5	30%	0.79	26	24	-7%
		100	30%	0.79	527	490	-8%
		1000	43%	1.95	3679	3411	-8%
		2000	46%	1.92	6884	6855	0%
	Reciprocating Engine (Rich Burn)	55	30%	0.63	290	304	4%
		100	28%	0.52	568	620	8%
		1000	29%	0.64	5514	5487	0%
		1200	28%	0.63	6759	6643	-2%

Abbreviations:
CHP - combined heat and power
CO_2 - carbon dioxide
HHV - higher heating value
kW - kilowatt
LADWP - Los Angeles Department of Water and Power

PGE - Pacific Gas and Electric
SCE - Southern California Edison
SDGE - San Diego Gas and Electric
SMUD - Sacramento Municipal Utility District
USEPA - United State Environmental Protection Agency

Notes:
1. All data in this table generated using the USEPA CHP Calculator using utility-specific CO_2 intensity factors (see Table B). The following defaults and assumptions for the CHP system were used:
   - electricity generating capacity based on normal range for the technology (as per Calculator default)
   - operate 8,760 hours per year
   - heating only (no cooling)
   - natural gas fuel (116.7 CO_2/MMBtu emission rate and 1,020 Btu/scf HHV as per Calculator defaults)
   - no duct burner
   - assumed 8% transmission loss for displaced electricity
2. All CHP systems were compared to a baseline separate heat and power system consisting of a "new gas boiler" (assumed 80% efficiency as per Calculator default) and the local utility CO_2 intensity factor as provided in Table B.
3. A negative value indicates that the proposed CHP system is expected to generate more CO_2 emissions than the baseline separate heat and power system.

Source:

USEPA. 2009. CHP Emissions Calculator. Available online at: http://www.epa.gov/chp/basic/calculator.html. Accessed April 2010.

Table AE-4.2
Carbon Intensity of California Utilities

Utility	Total From All Generation Sources[1]		
	Electricity	CO_2 Emissions	CO_2 intensity factor
	(MWh)	(MT)	(lb/MWh)
SCE	82,776,309	24,077,133	641
LADWP	29,029,883	16,308,526	1,239
SDGE	19,108,166	6,767,326	781
PGE	79,211,982	16,377,172	456
SMUD	15,133,569	3,811,571	555
eGRID National Average (default in USEPA CHP Calculator)[2,3]			540
eGRID National Fossil Fuel Average (default in USEPA CHP Calculator)[2,4]			1,076

Abbreviations:
CHP - combined heat and power
CO_2 - carbon dioxide
eGRID - Emissions and Generation Resource Integrated Database
LADWP - Los Angeles Department of Water and Power
lb - pound
MWh - megawatt-hour
PGE - Pacific Gas and Electric
SCE - Southern California Edison
SDGE - San Diego Gas and Electric
SMUD - Sacramento Municipal Utility District
USEPA - United State Environmental Protection Agency

Notes:
1. Total electricity and CO_2 emissions reported by the utility in the California Climate Action Registry Power/Utility Protocol (PUP) Reports for reporting year 2006. PUP Reports available online at: https://www.climateregistry.org/CARROT/public/reports.aspx.
2. eGRID is a comprehensive inventory of environmental attributes of electricity generation (such as the carbon intensity of power generation), compiled from data from three federal agencies: EPA, the Energy Information Administration (EIA), and the Federal Energy Regulatory Commission (FERC). The USEPA CHP Calculator provides default 2005 eGRID carbon intensities for the U.S. and California. For more information, see: http://www.epa.gov/rdee/energy-resources/egrid/index.html.
3. eGRID National Average represents the national average carbon intensity for electricity generation from all power sources (hydropower, nuclear, renewables, and fossil fuels including oil, natural gas, and coal).
4. eGRID National Fossil Fuel Average represents the national average carbon intensity for electricity generation from fossil fuel sources only (oil, natural gas, and coal).

2.3.5 Establish Methane Recovery in Landfills

Range of Effectiveness: 73-77% reduction in GHG emissions from landfills without methane recovery

Measure Description:

One of the U.S.'s largest sources of methane emissions is from the decomposition of waste in landfills. Methane (CH_4) is a potent GHG and has a global warming potential (GWP) over 20 times that of CO_2. Capturing methane in landfills and combusting it to generate electricity for on-site energy needs reduces GHG emissions in two ways: it reduces direct methane emissions, and it displaces electricity demand and the associated indirect GHG emissions from electricity production.

Measure Applicability:

- Electricity from utility
- Note: this mitigation measure does not include energy generation from burning municipal solid waste.

Inputs:

The following information needs to be provided by the Project Applicant:

- Amount of mixed solid waste (short tons)

Baseline Method:

In landfills without landfill gas recovery systems, greenhouse gases are emitted directly to the atmosphere.

$$CO_2e_{baseline} = MSW \times LFM \times (44/12)$$

Where

$CO_2e_{baseline}$	=	Amount of CO_2e generated from landfilling mixed solid waste (MT)
MSW	=	Amount of mixed solid waste (short tons) Provided by Applicant
LFM	=	Landfill methane generated from mixed solid waste 0.580 MTCE / short ton MSW
(44/12)	=	Conversion from MTCE to MT CO_2e

Mitigation Method:

Mitigation Option 1 – Methane is captured and flared

USEPA assumes that 10% of the landfill CH4 generated is either converted by bacteria or chemically oxidized to CO_2. The remaining 90% remains as CH4 and is either captured and flared[28] or released directly to the atmosphere as fugitive CH_4 emissions. Assume a 99% combustion conversion efficiency.

$$CO_2e_{Mit1} = MSW \times LFM \times 1/(12/44 \times 21) \times [(CO_{2oxidation} + CO_{2flare}) \times 1 + (CH_{4fugitive} + CH_{4unflare}) \times 21]$$

Where

CO_2e_{Mit1}	=	Amount of CO_2e from flaring landfill methane (MT)
MSW	=	Amount of mixed solid waste (short tons) Provided by Applicant
LFM	=	MTCE[29] methane generated per short ton MSW 0.580 MTCE / short ton MSW
1/(12/44 x 21)	=	Conversion from MTCE to MT CH_4
$CO_{2oxidation}$	=	Contribution from CO_2 generated from chemical or biological oxidation. 0.10
CO_{2flare}	=	Contribution from CO_2 generated from the flaring of methane. (1-0.10) x 0.75 x 0.99 = 0.66825
1	=	Global warming potential of CO_2, used to convert from CO_2 to CO_2e
$CH_{4fugitive}$	=	Contribution from CH_4 which remains unoxidized to CO_2 and is not captured for flaring, and therefore is released directly to the atmosphere. (1-0.10) x (1-0.75) = 0.225

[28] Seek local agency guidance on whether to include CO_{2flare} emissions. USEPA and IPCC consider these emissions to be biogenic; therefore, the emissions are not included in USEPA and IPCC greenhouse gas emissions inventories.
[29] MTCE = metric MTMTMTMT carbon equivalent. The MTCE equivalent of 1 MT of a greenhouse gas is (12/44) multiplied by the greenhouse gas global warming potential.

$CH_{4unflare}$	=	Contribution from CH_4 which remains unoxidized and is captured for flaring, but remains unconverted due to incomplete combustion. (1-0.10) x 0.75 x (1-0.99) = 0.00675
21	=	Global warming potential of CH_4, used to convert from CH_4 to CO_2e

Therefore:

CO_2e_{Mit1} = MSW x 0.580 x 1/(12/44 x 21) x [(0.76825 x 1) + (0.23175 x 21)]

CO_2eMit1 = MSW x 0.571

And then the percent reduction in GHG emissions from Mitigation Option 1 is:

$$\text{GHG reduction}_{Mit1} = \frac{CO_2e_{baseline} - CO_2e_{Mit1}}{CO_2e_{baseline}}$$

GHG reduction_{Mit1} = 73%

As shown from this equation, the percent reduction in greenhouse gas emissions does not depend on the amount of mixed solid waste in the landfill.

Mitigation Option 2 – Methane is captured and combusted for cogeneration

If a cogeneration system is used to generate electricity from the combusted methane, the following equation is used to calculate the amount of electricity generated:

Electricity = MSW x LFM x 1/(12/44 x 21) x Combust x Density x 10^6 x HHV x ECF x EFF x

Where

Electricity	=	Amount of electricity generated from combustion of methane (kWh)
LFM	=	MTCE methane generated per short ton MSW 0.580 MTCE / short ton MSW
1/(12/44 x 21)	=	Conversion from MTCE to MT CH_4
Combust	=	Fraction of CH_4 captured and combusted for cogeneration

(1-0.10) x 0.75 = 0.675; assumes 10% of methane is oxidized prior to capture and 75% capture efficiency

Density = Density of CH_4
0.05 ft^3 CH_4 / gram CH_4

10^6 = Conversion from grams to MT

HHV = Heating value of CH4
1,012 BTU / ft^3 CH_4

ECF = Energy conversion factor
0.00009 kWh/BTU

EFF = Efficiency Factor
0.85; USEPA assumes a 15% system efficiency loss to account for system down-time

Therefore:

Electricity = MSW x 265

Since this amount of electricity is generated on-site and no longer needs to be supplied by the local electricity utility, the indirect CO_2e emissions associated with that utility electricity generation are also avoided:

$$CO_2e_{displaced} = \text{Electricity} \times \text{Utility}$$

Where

Utility = Carbon intensity of Local Utility (MT CO_2e/kWh) from table below

Power Utility	Carbon-Intensity (lbs CO_2e/MWh)
LADW&P	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

Therefore:

$$\mathbf{CO_2e_{Mit2} = CO_2e_{Mit1} - CO_2e_{displaced}}$$

And then the percent reduction in GHG emissions from Mitigation 2 is:

$$\text{GHG reduction}_{Mit2} = \frac{CO_2e_{baseline} - \left(CO_2e_{Mit1} - CO_2e_{displaced}\right)}{CO_2e_{baseline}}$$

$$\textbf{GHG reductionMit2} = \frac{1.556 + (265 \times \text{Utility})}{2.127}$$

As shown from these equations, the percent reduction in GHG emissions does not depend on the amount of mixed solid waste in the landfill.

Note that further reductions could be achieved if the heat generated from combustion and cogeneration were recovered and used to displace thermal energy that otherwise would have been generated from a separate heat system, such as a boiler. The magnitude of reductions depends on the system being displaced, including the boiler efficiency and the heating value of the fuel as compared to the heating value of methane. To take credit for this additional reduction, the Project Applicant would need to quantify displaced GHG emissions using the baseline document and the Mitigation Measure BE-5, Install Energy Efficient Boilers.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	73-77%
All other pollutants	Not Quantified[30]

Discussion:

In Southern California Edison's service area, a landfill which captures and flares methane achieves a 73% reduction in GHG emissions compared to a landfill without a methane recovery system. A landfill which captures and combusts methane for cogeneration achieves a 77% reduction in GHG emissions compared to a landfill without a methane recovery system:

$$\text{GHG reduction Mit2} = \frac{1.556 + \left(265 \times 2.909 \times 10^{-4}\right)}{2.127} = 77\%$$

Assumptions:

[30] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

Data based upon the following reference:

- USEPA. 2006. Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks, 3rd Ed. Available online at: http://www.epa.gov/climatechange/wycd/waste/downloads/fullreport.pdf

Preferred Literature:

Section 6 of USEPA's Solid Waste Management and Greenhouse Gases report presents methodology for calculating greenhouse gas emissions associated with three different landfill management systems: landfills which do not capture landfill gas, landfills which recover methane and flare it, and landfills which recover methane and combust it for cogeneration. Column (b) of Exhibit 6-6 shows methane generation factors for various types of landfill waste in MTCE per short ton of waste. For this analysis, the value for mixed solid waste is used. Section 6.2 provides USEPA defaults for percent of methane chemically or biologically oxidized to CO_2 (10%) and the efficiency of methane capture systems (75%). Exhibit 6-7 provides USEPA defaults used for calculating the amount of electricity generated from methane combustion and cogeneration.

Alternative Literature:

None

Other Literature Reviewed:

- CAR. 2009. Landfill Project Protocol: Collecting and Destroying Methane from Landfills. Version 3.0. Available online at: http://www.climateactionreserve.org/how/protocols/adopted/landfill/current-landfill-project-protocol/
- CalRecycle (CIWMB). Climate Change and Solid Waste Management: Draft Final Report and Draft GHG Calculator Tool. Available online at: http://www.calrecycle.ca.gov/Climate/Organics/LifeCycle/default.htm. Accessed February 2010.
- CARB. 2008. Local Government Operations Protocol. Version 1.0. Available online at: http://www.arb.ca.gov/cc/protocols/localgov/pubs/final_lgo_protocol_2008-09-25.pdf
- American Carbon Registry. Standards. Available online at: http://www.americancarbonregistry.org/carbon-accounting/standards/?searchterm=landfill. Accessed February 2010.

2.3.6 Establish Methane Recovery in Wastewater Treatment Plants

Range of Effectiveness: 95-97% reduction in GHG emissions from wastewater treatment plants without recovery.

Measure Description:

Methane (CH_4) is a potent GHG and has a global warming potential (GWP) over 20 times that of CO_2. Capturing methane from wastewater treatment (WWT) plants and combusting it to generate electricity for on-site energy needs reduces GHG emissions in two ways: it reduces direct methane emissions, and it displaces electricity demand and the associated indirect GHG emissions from electricity production.

Measure Applicability:

- Electricity from utility

Inputs:

The following information needs to be provided by the Project Applicant:

- Liters of wastewater

Baseline Method:

Centralized wastewater treatment facilities may use anaerobic or facultative lagoons or anaerobic digesters to treat wastewater. The methane emissions expected from anaerobic or facultative lagoons is calculated using the following equation from the California Air Resources Board (CARB)'s Local Government Reporting Protocol:

$$CO_2e_{baseline} = \text{Wastewater} \times BOD_5 \text{ load} \times 10^{-6} \times Bo \times MCF_{anaerobic} \times 10^{-3} \times 21$$

Where

$CO_2e_{baseline}$	=	Amount of CO_2e generated from wastewater treatment (MT)
Wastewater	=	Volume of wastewater (liters) Provided by Applicant
BOD_5 load	=	Concentration of BOD_5 in wastewater 200 mg / liter wastewater
10^{-6}	=	Conversion from mg to kg
Bo	=	Maximum CH_4-producing capacity for domestic wastewater 0.6 kg CH_4 / kg BOD_5 removed
$MCF_{anaerobic}$	=	CH_4 correction factor for anaerobic systems 0.8
10^{-3}	=	Conversion from kg to MT

21 = Global warming potential of CH_4, used to convert from CH_4 to CO_2e

Therefore:

$$CO_2e_{baseline} = Wastewater \times 2.02 \times 10^{-6}$$

Mitigation Method:

Mitigation Option 1 – Methane is captured and flared

Anaerobic digesters produce methane-rich biogas which can be combusted and converted to CO_2.[31] Inherent inefficiencies in the system results in incomplete combustion of the biogas, which results in remaining methane emissions:

$$CO_2e_{Mit1} = Wastewater \times 0.2642 \times Digester\ Gas \times FCH_4 \times (CH_4unflare + CO_2flare)$$

Where

CO_2e_{Mit1}	=	Amount of CO_2e generated from flaring methane from wastewater treatment plant (MT)
Wastewater	=	Volume of wastewater (liters) Provided by Applicant
0.2642	=	Conversion from liters to gallons
Digester Gas	=	Volume of biogas generated per volume of wastewater treated ft^3 biogas / gallon wastewater 0.01
F_{CH4}	=	Fraction of CH_4 in biogas 0.65
$CH_{4unflare}$	=	Contribution from CH_4 which is captured for flaring, but remains unconverted due to incomplete combustion $CH_{4unflare} = \rho_{CH4} \times (1\text{-}DE) \times 0.0283 \times 10^{-6} \times 21 = 3.93 \times 10^{-6}$
ρ_{CH4}	=	Density of CH4 at standard conditions 662 g/m^3
DE	=	CH_4 destruction efficiency 0.99
0.0283	=	Conversion factor from ft^3 to m^3
10^{-6}	=	Conversion factor from g to MT
21	=	Global warming potential of CH_4, used to convert from CH_4 to CO_2e
CO_2flare	=	Contribution from CO_2 generated from the flaring of methane
CO_2flare	=	$EF / 2204.623 \times 1 = 5.44 \times 10^{-5}$
EF	=	Emission factor for methane combustion

[31] Seek local agency guidance on whether to include CO_2 combustion emissions. USEPA and IPCC consider these emissions to be biogenic; therefore, the emissions are not included in USEPA and IPCC greenhouse gas emissions inventories.

		$0.120\ lb\ CO_2/ft^3\ CH_4$
2204.623	=	Conversion factor from lb to MT
1	=	Global warming potential of CO_2, used to convert from CO_2 to CO_2e

Therefore:

$$\mathbf{CO_2e_{Mit1} = Wastewater \times 1.00 \times 10^{-7}}$$

And then the percent reduction in GHG emissions from Mitigation Option 1 is:

$$GHG\ reduction_{Mit1} = \frac{CO_2e_{baseline} - CO_2e_{Mit1}}{CO_2e_{baseline}}$$

$$\mathbf{GHG\ reduction_{Mit1} = 95\%}$$

As shown from this equation, the percent reduction in greenhouse gas emissions does not depend on the amount of wastewater being treated.

Mitigation Option 2 – Methane is captured and combusted for cogeneration

If a cogeneration system is used to generate electricity from the combusted biogas, the following equation is used to calculate the amount of electricity generated:

$$Electricity = Wastewater \times 0.2642 \times Digester\ Gas \times F_{CH4} \times HHV_{CH4} \times ECF \times EFF$$

Where:

Electricity	=	Amount of electricity generated from combustion of methane (kWh)
Wastewater	=	Volume of wastewater (liters) Provided by Applicant
0.2642	=	Conversion from liters to gallons
Digester Gas	=	Volume of biogas generated per volume of wastewater treated $0.01\ ft^3$ biogas / gallon wastewater
F_{CH4}	=	Fraction of CH_4 in biogas 0.65
HHV	=	Heating value of methane $1{,}012\ BTU / ft^3\ CH_4$
ECF	=	Energy conversion factor 0.00009 kWh/BTU
EFF	=	Efficiency Factor 0.85; USEPA assumes a 15% system efficiency loss to account for system down-time

Therefore:

$$\text{Electricity} = \text{Wastewater} \times 1.33 \times 10^{-4}$$

Since this amount of electricity is generated on-site and no longer needs to be supplied by the local electricity utility, the indirect CO_2e emissions associated with that utility electricity generation are also avoided:

$$CO_2e_{displaced} = \text{Electricity} \times \text{Utility}$$

Where

Utility = Carbon intensity of Local Utility (MT CO_2e/kWh) from table below

Power Utility	Carbon-Intensity (lbs CO_2e/MWh)
LADW&P	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

Therefore:

$$\mathbf{CO_2e_{Mit2} = CO_2e_{Mit1} - CO_2e_{displaced}}$$

And then the percent reduction in GHG emissions from Mitigation 2 is:

$$\text{GHG reduction}_{Mit2} = \frac{CO2e_{baseline} - (CO2e_{Mit1} - CO2e_{displaced})}{CO2e_{baseline}}$$

$$\textbf{GHG reductionMit2} = \frac{1.92 \times 10^{-6} + (1.33 \times 10^{-4} \times \text{Utility})}{2.02 \times 10^{-6}}$$

As shown from these equations, the percent reduction in GHG emissions does not depend on the amount of wastewater being treated.

Note that further reductions could be achieved if the heat generated from combustion and cogeneration were recovered and used to displace thermal energy that otherwise would have been generated from a separate heat system, such as a boiler. The magnitude of reductions depends on the system being displaced, including the boiler efficiency and the heating value of the fuel as compared to the heating value of methane. To take credit for this additional reduction, the Project Applicant would need to quantify displaced GHG emissions using the baseline document and the Mitigation Measure BE-5, Install Energy Efficient Boilers.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	95-97%
All other pollutants	Not Quantified[32]

Discussion:

In Southern California Edison's service area, a WWT plant which captures and flares methane achieves a 95% reduction in GHG emissions compared to a WWT plant without a methane recovery system. A WWT plant which captures and combusts methane for cogeneration achieves a 97% reduction in GHG emissions compared to a landfill without a methane recovery system:

$$\text{GHG reduction Mit2} = \frac{1.92 \times 10^{-6} + \left(1.33 \times 10^{-4} \times 2.909 \times 10^{-4}\right)}{2.02 \times 10^{-6}} = 97\%$$

Assumptions:

Data based upon the following references:

- CARB. 2008. Local Government Operations Protocol. Chapter 10: Wastewater Treatment Facilities. Available online at: http://www.arb.ca.gov/cc/protocols/localgov/pubs/final_lgo_protocol_2008-09-25.pdf
- USEPA. 2008. Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006. Chapter 8: Waste. Available online at: http://www.epa.gov/climatechange/emissions/downloads/08_CR.pdf
- USEPA. 2006. Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks, 3rd Ed. Available online at: http://www.epa.gov/climatechange/wycd/waste/downloads/fullreport.pdf

Preferred Literature: Chapter 10 of CARB's Local Government Operations Protocol (LGOP) provides the methodology for calculating methane emissions from wastewater treatment. Centralized wastewater treatment facilities may use anaerobic or facultative lagoons or anaerobic digesters to treat wastewater. Equation 10.3 of the LGOP calculates methane emissions from anaerobic or facultative lagoons. Equation 10.1 of the LGOP calculates the methane emissions remaining due to incomplete combustion of anaerobic digester gas. Default values for the amount of digester gas produced per volume of wastewater and the fraction of methane in digester gas are taken from the 2008 USEPA Inventory of U.S. Greenhouse Gas Emissions and Sinks. Exhibit 6-7 of

[32] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

USEPA's Solid Waste Management and Greenhouse Gases report provides the methodology for calculating the amount of electricity generated from methane combustion and cogeneration.

Alternative Literature:

None

Other Literature Reviewed:

None

3.0 Transportation

3.1 Land Use/Location

3.1.1 Increase Density

Range of Effectiveness: 0.8 – 30.0% vehicle miles traveled (VMT) reduction and therefore a 0.8 – 30.0% reduction in GHG emissions.

Measure Description:

Designing the Project with increased densities, where allowed by the General Plan and/or Zoning Ordinance reduces GHG emissions associated with traffic in several ways. Density is usually measured in terms of persons, jobs, or dwellings per unit area. Increased densities affect the distance people travel and provide greater options for the mode of travel they choose. This strategy also provides a foundation for implementation of many other strategies which would benefit from increased densities. For example, transit ridership increases with density, which justifies enhanced transit service.

The reductions in GHG emissions are quantified based on reductions to VMT. The relationship between density and VMT is described by its elasticity. According to a recent study published by Brownstone, et al. in 2009, the elasticity between density and VMT is 0.12. Default densities are based on the typical suburban densities in North America which reflects the characteristics of the ITE Trip Generation Manual data used in the baseline estimates.

Measure Applicability:

- Urban and suburban context
    - Negligible impact in a rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Number of housing units per acre or jobs per job acre

Mitigation Method:

% VMT Reduction = A * B [not to exceed 30%]

Where:

A = Percentage increase in housing units per acre or jobs per job acre[33] = (number of housing units per acre or jobs per job acre – number of housing units per acre or jobs per job acre for typical ITE development) / (number of housing units per acre or jobs per job acre for typical ITE development) For small and medium sites (less than ½ mile in radius) the calculation of housing and jobs per acre should be performed for the development site as a whole, so that the analysis does not erroneously attribute trip reduction benefits to measures that simply shift jobs and housing within the site with no overall increase in site density. For larger sites, the analysis should address the development as several ½-mile-radius sites, so that shifts from one area to another would increase the density of the receiving area but reduce the density of the donating area, resulting in trip generation rate decreases and increases, respectively, which cancel one another.
B = Elasticity of VMT with respect to density (from literature)

Detail:

- A: [not to exceed 500% increase]
  - If housing: (Number of housing units per acre – 7.6) / 7.6 (See Appendix C for detail)
  - If jobs: (Number of jobs per acre – 20) / 20 (See Appendix C for detail)
- B: 0.07 (Boarnet and Handy 2010)

Assumptions:

Data based upon the following references:

- Boarnet, Marlon and Handy, Susan. 2010. "DRAFT Policy Brief on the Impacts of Residential Density Based on a Review of the Empirical Literature." http://arb.ca.gov/cc/sb375/policies/policies.htm; Table 1.

[33] This value should be checked first to see if it exceeds 500% in which case A = 500%.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[34]
CO_2e	1.5-30% of running
PM	1.5-30% of running
CO	1.5-30% of running
NOx	1.5-30% of running
SO_2	1.5-30% of running
ROG	0.9-18% of total

Discussion:

The VMT reductions for this strategy are based on changes in density versus the typical suburban residential and employment densities in North America (referred to as "ITE densities"). These densities are used as a baseline to mirror those densities reflected in the ITE Trip Generation Manual, which is the baseline method for determining VMT.

There are two separate maxima noted in the fact sheet: a cap of 500% on the allowable percentage increase of housing units or jobs per acre (variable A) and a cap of 30% on % VMT reduction. The rationale for the 500% cap is that there are diminishing returns to any change in environment. For example, it is reasonably doubtful that increasing residential density by a factor of six instead of five would produce any additional change in travel behavior. The purpose for the 30% cap is to limit the influence of any single environmental factor (such as density). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, etc.) will show more of a reduction than relying on improvements from a single land use factor.

Example:

Sample calculations are provided below for housing:

Low Range % VMT Reduction (8.5 housing units per acre)

= (8.5 – 7.6) / 7.6 *0.07 = 0.8%

High Range % VMT Reduction (60 housing units per acre)

$$= \frac{60 - 7.6}{7.6} = 6.9 \text{ or } 690\% \quad \text{Since greater than 500\%, set to 500\%}$$

= 500% x 0.07 = 0.35 or 35% Since greater than 30%, set to 30%

[34] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Sample calculations are provided below for jobs:

Low Range % VMT Reduction (25 jobs per acre)

= (25 – 20) / 20 *0.12 = 3%

High Range % VMT Reduction (100 jobs per acre)

$$= \frac{100 - 20}{20} = 4 \text{ or } 400\%$$

=400% x 0.12 = 0.48 or 48% Since greater than 30%, set to 30%

Preferred Literature:

- -0.07 = elasticity of VMT with respect to density

Boarnet and Handy's detailed review of existing literature highlighted three individual studies that used the best available methods for analyzing data for individual households. These studies provided the following elasticities: -0.12 - Brownstone (2009), -0.07 – Bento (2005), and -0.08 – Fang (2008). To maintain a conservative estimate of the impacts of this strategy, the lower elasticity of -0.07 is used in the calculations.

Alternative Literature:

- -0.05 to -0.25 = elasticity of VMT with respect to density

The *TRB Special Report 298* literature suggests that doubling neighborhood density across a metropolitan area might lower household VMT by about 5 to 12 percent, and perhaps by as much as 25 percent, if coupled with higher employment concentrations, significant public transit improvements, mixed uses, and other supportive demand management measures.

Alternative Literature References:

TRB, 2009. *Driving and the Built Environment*, Transportation Research Board Special Report 298. http://onlinepubs.trb.org/Onlinepubs/sr/sr298.pdf . Accessed March 2010. (p. 4)

Other Literature Reviewed:

None

3.1.2 Increase Location Efficiency

Range of Effectiveness: 10-65% vehicle miles traveled (VMT) reduction and therefore 10-65% reduction in GHG emissions

Measure Description:

This measure is not intended as a separate strategy but rather a documentation of empirical data to justify the "cap" for all land use/location strategies. The location of the Project relative to the type of urban landscape such as being located in an urban area, infill, or suburban center influences the amount of VMT compared to the statewide average. This is referred to as the location of efficiency since there are synergistic benefits to these urban landscapes.

To receive the maximum reduction for this location efficiency, the project will be located in an urban area/ downtown central business district. Projects located on brownfield sites/infill areas receive a lower, but still significant VMT reduction. Finally, projects in suburban centers also receive a reduction for their efficient location. Reductions are based on the typical VMT of a specific geographic area relative to the average VMT statewide.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = emission factor for running emissions

Inputs:

- No inputs are needed. VMT reduction ranges are based on the geographic location of the project within the region.

Mitigation Method:

% VMT reduction =

- Urban: 65% (representing VMT reductions for the average urban area in California versus the statewide average VMT)
- Compact Infill: 30% (representing VMT reductions for the average compact infill area in California versus the statewide average VMT)
- Suburban Center: 10% (representing VMT reductions for the average suburban center in California versus the statewide average VMT)

Assumptions:

Data based upon the following references:

- Holtzclaw, et al. 2002. "Location Efficiency: Neighborhood and Socioeconomic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles, and Chicago." *Transportation Planning and Technology*, Vol. 25, pp. 1–27.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[35]
CO_2e	10-65% of running
PM	10-65% of running
CO	10-65% of running
NOx	10-65% of running
SO_2	10-65% of running
ROG	6-39% of total

Discussion:

Example:

N/A – no calculations needed

Alternative Literature:

- 13-72% reduction in VMT for infill projects

Preferred Literature:

Holtzclaw, et al., [1] studied relationships between auto ownership and mileage per car and neighborhood urban design and socio-economic characteristics in the Chicago, Los

[35] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Angeles, and San Francisco metro areas. In all three regions, average annual vehicle miles traveled is a function of density, income, household size, and public transit, as well as pedestrian and bicycle orientation (to a lesser extent). The annual VMT for each neighborhood was reviewed to determine empirical VMT reduction "caps" for this report. These location-based caps represent the average and maximum reductions that would likely be expected in urban, infill, suburban center, and suburban locations.

Growing Cooler looked at 10 studies which have considered the effects of regional location on travel and emissions generated by individual developments. The studies differ in methodology and context but they tend to yield the same conclusion: infill locations generate substantially lower VMT per capita than do greenfield locations, ranging from 13 - 72% lower VMT.

Literature References:

[1] Holtzclaw, et al. 2002. "Location Efficiency: Neighborhood and Socioeconomic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles, and Chicago." *Transportation Planning and Technology*, Vol. 25, pp. 1–27.

[2] Ewing, et al, 2008. Growing Cooler – The Evidence on Urban Development and Climate Change. Urban Land Institute. (p.88, Figure 4-30)

Other Literature Reviewed:

None

3.1.3 Increase Diversity of Urban and Suburban Developments (Mixed Use)

Range of Effectiveness: 9-30% vehicle miles traveled (VMT) reduction and therefore 9-30% reduction in GHG emissions.

Measure Description:

Having different types of land uses near one another can decrease VMT since trips between land use types are shorter and may be accommodated by non-auto modes of transport. For example when residential areas are in the same neighborhood as retail and office buildings, a resident does not need to travel outside of the neighborhood to meet his/her trip needs. A description of diverse uses for urban and suburban areas is provided below.

Urban:

The urban project will be predominantly characterized by properties on which various uses, such as office, commercial, institutional, and residential, are combined in a single building or on a single site in an integrated development project with functional interrelationships and a coherent physical design. The mixed-use development should encourage walking and other non-auto modes of transport from residential to office/commercial/institutional locations (and vice versa). The residential units should be within ¼-mile of parks, schools, or other civic uses. The project should minimize the need for external trips by including services/facilities for day care, banking/ATM, restaurants, vehicle refueling, and shopping.

Suburban:

The suburban project will have at least three of the following on site and/or offsite within ¼-mile: Residential Development, Retail Development, Park, Open Space, or Office. The mixed-use development should encourage walking and other non-auto modes of transport from residential to office/commercial locations (and vice versa). The project should minimize the need for external trips by including services/facilities for day care, banking/ATM, restaurants, vehicle refueling, and shopping.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context (unless the project is a master-planned community)
- Appropriate for mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of each land use type in the project (to calculate land use index)

Mitigation Method:

% VMT Reduction = Land Use * B [not to exceed 30%]

Where

Land Use = Percentage increase in land use index versus single use development

= (land use index – 0.15)/0.15 (see Appendix C for detail)

Land use index = -a / ln(6) (from [2])

$$a = \sum_{i=1}^{6} a_i \times \ln(a_i)$$

a_i = building floor area of land use i / total square feet of area considered

- a_1 = single family residential
- a_2 = multifamily residential
- a_3 = commercial
- a_4 = industrial
- a_5 = institutional
- a_6 = park

if land use is not present and a_i is equal to 0, set a_i equal to 0.01

B = elasticity of VMT with respect to land use index (0.09 from [1])

not to exceed 500% increase

Assumptions:

Data based upon the following references:

[1] Ewing, R., and Cervero, R., "Travel and the Built Environment - A Meta-Analysis." *Journal of the American Planning Association*, <to be published> (2010). Table 4.

[2] Song, Y., and Knaap, G., "Measuring the effects of mixed land uses on housing values." *Regional Science and Urban Economics 34 (2004) 663-680.* (p. 669) http://urban.csuohio.edu/~sugie/papers/RSUE/RSUE2005_Measuring%20the%20effects%20of%20mixed%20land%20use.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[36]
CO_2e	9-30% of running
PM	9-30% of running
CO	9-30% of running
NOx	9-30% of running
SO_2	9-30% of running
ROG	5.4-18% of total

Discussion:

In the above calculation, a land use index of 0.15 is used as a baseline representing a development with a single land use (see Appendix C for calculations).

There are two separate maxima noted in the fact sheet: a cap of 500% on the allowable percentage increase of land use index (variable A) and a cap of 30% on % VMT reduction. The rationale for the 500% cap is that there are diminishing returns to any change in environment. For example, it is reasonably doubtful that increasing the land use index by a factor of six instead of five would produce any additional change in travel behavior. The purpose for the 30% cap is to limit the influence of any single environmental factor (such as diversity). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, etc.) will show more of a reduction than relying on improvements from a single land use factor.

[36] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Example:

Sample calculations are provided below:

90% single family homes, 10% commercial

- Land use index = -[0.9*ln(0.9)+ 0.1*ln(0.1)+ 4*0.01*ln(0.01)] / ln(6) = 0.3
- Low Range % VMT Reduction = (0.3 – 0.15)/0.15 *0.09 = 9%

1/6 single family, 1/6 multi-family, 1/6 commercial, 1/6 industrial, 1/6 institutional, 1/6 parks

- Land use index = -[6*0.17*ln(0.17)] / ln(6) = 1
- High Range % VMT Reduction (land use index = 1)
- Land use = (1-0.15)/0.15 = 5.6 or 566%. Since this is greater than 500%, set to 500%.
- % VMT Reduction = (5 x 0.09) = 0.45 or 45%. Since this is greater than 30%, set to 30%.

Preferred Literature:

- -0.09 = elasticity of VMT with respect to land use index

The land use (or entropy) index measurement looks at the mix of land uses of a development. An index of 0 indicates a single land use while 1 indicates a full mix of uses. Ewing's [1] synthesis looked at a total of 10 studies, where none controlled for self-selection[37]. The weighted average elasticity of VMT with respect to the land use mix index is -0.09. The methodology for calculating the land use index is described in Song and Knaap [2].

Alternative Literature:

- Vehicle trip reduction = [1 - (ABS(1.5*h-e) / (1.5*h+e)) - 0.25] / 0.25*0.03

Where :
h = study area housing units, and
e = study area employment.

Nelson\Nygaard's report [3] describes a calculation adapted from Criterion and Fehr & Peers [4]. The formula assumes an "ideal" housing balance of 1.5 jobs per household and a baseline diversity of 0.25. The maximum trip reduction with this method is 9%.

[37] Self selection occurs when residents or employers that favor travel by non-auto modes choose locations where this type of travel is possible. They are therefore more inclined to take advantage of the available options than a typical resident or employee might otherwise be.

Alternative Literature References:

[3] Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p.12). http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf

[4] Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. *A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*. Technical Memorandum prepared for US EPA, October 2001.

Other Literature Reviewed:

None

3.1.4 Increase Destination Accessibility

Range of Effectiveness: 6.7 – 20% vehicle miles traveled (VMT) reduction and therefore 6.7-20% reduction in GHG emissions.

Measure Description:

The project will be located in an area with high accessibility to destinations. Destination accessibility is measured in terms of the number of jobs or other attractions reachable within a given travel time, which tends to be highest at central locations and lowest at peripheral ones. The location of the project also increases the potential for pedestrians to walk and bike to these destinations and therefore reduces the VMT.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Distance to downtown or major job center

Mitigation Method:

% VMT Reduction = Center Distance * B [not to exceed 30%]

Where

Center Distance = Percentage decrease in distance to downtown or major job center versus typical ITE suburban development = (distance to downtown/job center for typical ITE development – distance to downtown/job center for project) / (distance to downtown/job center for typical ITE development)

Center Distance = 12 - Distance to downtown/job center for project) / 12
See Appendix C for detail

B = Elasticity of VMT with respect to distance to downtown or major job center (0.20 from [1])

Assumptions:
Data based upon the following references:

[1] Ewing, R., and Cervero, R., "Travel and the Built Environment - A Meta-Analysis." Journal of the American Planning Association, <to be published> (2010). Table 4.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[38]
CO_2e	6.7 – 20% of running
PM	6.7 – 20% of running
CO	6.7 – 20% of running
NOx	6.7 – 20% of running
SO_2	6.7 – 20% of running
ROG	4 – 12% of total

Discussion:
The VMT reductions for this strategy are based on changes in distance to key destinations versus the standard suburban distance in North America. This distance is used as a baseline to mirror the distance to destinations reflected in the land uses for the ITE Trip Generation Manual, which is the baseline method for determining VMT.

The purpose for the 30% cap on % VMT reduction is to limit the influence of any single environmental factor (such as destination accessibility). This emphasizes that community designs that implement multiple land use strategies (such as density,

[38] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

design, diversity, destination, etc.) will show more of a reduction than relying on improvements from a single land use factor.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (8 miles to downtown/job center) =
  $$\frac{12-8}{12}\times 0.20 = 6.7\%$$
- High Range % VMT Reduction (0.1 miles to downtown/job center) =
  $$\frac{12-0.1}{12}\times 0.20 = 20.0\%$$

Preferred Literature:

- -0.20 = elasticity of VMT with respect to job accessibility by auto
- -0.20 = elasticity of VMT with respect to distance to downtown

The Ewing and Cervero report [1] finds that VMT is strongly related to measures of accessibility to destinations. The weighted average elasticity of VMT with respect to job accessibility by auto is -0.20 (looking at five total studies). The weighted average elasticity of VMT with respect to distance to downtown is -0.22 (looking at four total studies, of which one controls for self selection[39]).

Alternative Literature:

- 10-30% reduction in vehicle trips

The VTPI literature [2] suggests a 10-30% reduction in vehicle trips for "smart growth" development practices that result in more compact, accessible, multi-modal communities where travel distances are shorter, people have more travel options, and it is possible to walk and bicycle more.

Alternative Literature References:

[2] Litman, T., 2009. "Win-Win Emission Reduction Strategies." Victoria Transport Policy Institute (VTPI). Website: http://www.vtpi.org/wwclimate.pdf. Accessed March 2010. (p. 7, Table 3)

[39] Self selection occurs when residents or employers that favor travel by non-auto modes choose locations where this type of travel is possible. They are therefore more inclined to take advantage of the available options than a typical resident or employee might otherwise be.

Other Literature Reviewed:

None

3.1.5 Increase Transit Accessibility

Range of Effectiveness: 0.5 – 24.6% VMT reduction and therefore 0.5-24.6% reduction in GHG emissions.[40]

Measure Description:

Locating a project with high density near transit will facilitate the use of transit by people traveling to or from the Project site. The use of transit results in a mode shift and therefore reduced VMT. A project with a residential/commercial center designed around a rail or bus station, is called a transit-oriented development (TOD). The project description should include, at a minimum, the following design features:

- A transit station/stop with high-quality, high-frequency bus service located within a 5-10 minute walk (or roughly ¼ mile from stop to edge of development), and/or
    - A rail station located within a 20 minute walk (or roughly ½ mile from station to edge of development)
- Fast, frequent, and reliable transit service connecting to a high percentage of regional destinations
- Neighborhood designed for walking and cycling

In addition to the features listed above, the following strategies may also be implemented to provide an added benefit beyond what is documented in the literature:

- Mixed use development [LUT-3]
- Traffic calmed streets with good connectivity [SDT-2]
- Parking management strategies such as unbundled parking, maximum parking requirements, market pricing implemented to reduce amount of land dedicated to vehicle parking [see PPT-1 through PPT-7]

Measure Applicability:

- Urban and suburban context
- Appropriate in a rural context if development site is adjacent to a commuter rail station with convenient rail service to a major employment center
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

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[40] Transit vehicles may also result in increases in emissions that are associated with electricity production or fuel use. The Project Applicant should consider these potential additional emissions when estimating mitigation for these measures.

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Distance to transit station in project

Mitigation Method:

% VMT = Transit * B [not to exceed 30%]

Where

Transit = Increase in transit mode share = % transit mode share for project - % transit mode share for typical ITE development (1.3% as described in Appendix C)

% transit mode share for project (see Table)

Distance to transit	Transit mode share calculation equation (where x = distance of project to transit)
0 – 0.5 miles	-50*x + 38
0.5 to 3 miles	-4.4*x + 15.2
> 3 miles	no impact
Source: Lund et al, 2004; Fehr & Peers 2010 (see Appendix C for calculation detail)	

B = adjustments from transit ridership increase to VMT (0.67, see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Lund, H. and R. Cervero, and R. Willson (2004). *Travel Characteristics of Transit-Oriented Development in California*. (p. 79, Table 5-25)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[41]
CO_2e	0.5 – 24.6% of running
PM	0.5 – 24.6% of running
CO	0.5 – 24.6% of running
NOx	0.5 – 24.6% of running
SO_2	0.5 – 24.6% of running
ROG	0.3 – 14.8% of total

Discussion:

The purpose for the 30% cap on % VMT reduction is to limit the influence of any single environmental factor (such as transit accessibility). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, transit accessibility, etc.) will show more of a reduction than relying on improvements from a single land use factor.

Example:

Sample calculations are provided below for a rail station:

- Low Range % VMT Reduction (3 miles from station) = [(-4.4*3+15.2) – 1.3%] * 0.67 = 0.5%
- High Range % VMT Reduction (0 miles from station) = [(-50*0+38) – 1.3%] * 0.67 = 24.6%

Preferred Literature:

- 13 to 38% transit mode share (residents in TODs with ½ mile of rail station)
- 5 to 13% transit mode share (residents in TODs from ½ mile to 3 miles of rail station)

The *Travel Characteristics* report [1] surveyed TODs and surrounding areas in San Diego, Los Angeles, San Jose, Sacramento, and Bay Area regions. Survey sites are all located in non-central business district locations, are within walking distance of a transit station with rail service headways of 15 minutes or less, and were intentionally developed as TODs.

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[41] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Alternative Literature:

Alternate:

- -0.05 = elasticity of VMT with respect to distance to nearest transit stop

Ewing and Cervero's meta-analysis [2] provides this weighted average elasticity based on six total studies, of which one controls for self-selection. The report does not provide the range of distances where this elasticity is valid.

Alternate:

- 5.9 – 13.3% reduction in VMT

The Bailey, et al. 2008 report [3] predicted a reduction of household daily VMT of 5.8 miles for a location next to a rail station and 2.6 miles for a location next to a bus station. Using the report's estimate of 43.75 daily average miles driven, the estimated reduction in VMT for rail accessibility is 13.3% (5.8/43.75) and for bus accessibility is 5.9% (2.6/43.75).

Alternate:

- 15% reduction in vehicle trips
- 2 to 5 times higher transit mode share

TCRP Report 128 [4] concludes that transit-oriented developments, compared to typical developments represented by the *ITE Trip Generation Manual*, have 47% lower vehicle trip rates and have 2 to 5 times higher transit mode share. *TCRP Report 128* notes that the *ITE Trip Generation Manual* shows 6.67 daily trips per unit while detailed counts of 17 residential TODs resulted in 3.55 trips per unit (a 47% reduction in vehicle trips). This study looks at mid-rise and high-rise apartments at the residential TOD sites. A more conservative comparison would be to look at the *ITE Trip Generation Manual* rates for high-rise apartments, 4.2 trips per unit. This results in a 15% reduction in vehicle trips.

Alternative Literature References:

[2] Ewing, R., and Cervero, R., "Travel and the Built Environment - A Meta-Analysis." *Journal of the American Planning Association*, <to be published> (2010). Table 4.

[3] Bailey, L., Mokhtarian, P.L., & Little, A. (2008). "The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction." ICF International. (Table 4 and 5)

[4] TCRP, 2008. *TCRP Report 128 - Effects of TOD on Housing, Parking, and Travel.* http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_128.pdf (p. 11, 69).

Other Literature Reviewed:

None

3.1.6 Integrate Affordable and Below Market Rate Housing

Range of Effectiveness: 0.04 – 1.20% vehicle miles traveled (VMT) reduction and therefore 0.04-1.20% reduction in GHG emissions.

Measure Description:

Income has a statistically significant effect on the probability that a commuter will take transit or walk to work [4]. BMR housing provides greater opportunity for lower income families to live closer to jobs centers and achieve jobs/housing match near transit. It also addresses to some degree the risk that new transit oriented development would displace lower income families. This strategy potentially encourages building a greater percentage of smaller units that allow a greater number of families to be accommodated on infill and transit-oriented development sites within a given building footprint and height limit. Lower income families tend to have lower levels of auto ownership, allowing buildings to be designed with less parking which, in some cases, represents the difference between a project being economically viable or not.

Residential development projects of five or more dwelling units will provide a deed-restricted low-income housing component on-site.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context unless transit availability and proximity to jobs/services are existing characteristics
- Appropriate for residential and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of units in project that are deed-restricted BMR housing

Mitigation Method:

% VMT Reduction = 4% * Percentage of units in project that are deed-restricted BMR housing [1]

Assumptions:

Data based upon the following references:

[1] Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p.15). http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf

Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. *A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*. Technical Memorandum prepared for US EPA, October 2001.

Holtzclaw, John; Clear, Robert; Dittmar, Hank; Goldstein, David; and Haas, Peter (2002), "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles and San Francisco", *Transportation Planning and Technology*, 25 (1): 1-27.

All trips affected are assumed average trip lengths to convert from percentage vehicle trip reduction to VMT reduction (%VT = %VMT)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[42]
CO_2e	0.04 – 1.20% of running
PM	0.04 – 1.20% of running
CO	0.04 – 1.20% of running
NOx	0.04 – 1.20% of running
SO_2	0.04 – 1.20% of running
ROG	0.024 – 0.72% of total

Discussion:

At a low range, 1% BMR housing is assumed. At a medium range, 15% is assumed (based on the requirements of the San Francisco BMR Program[5]). At a high range, the San Francisco program is doubled to reach 30% BMR. Higher percentages of BMR are possible, though not discussed in the literature or calculated.

[42] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction = 4% * 1% = 0.04%
- High Range % VMT Reduction = 4% * 30% = 1.20%

Preferred Literature:

Nelson\Nygaard [1] provides a 4% reduction in vehicle trips for each deed-restricted BMR unit. This is calculated from Holtzclaw [3], with the following assumptions: 12,000 average annual VMT per vehicle, $33,000 median per capita income (2002 figures per CA State Department of Finance), and average income in BMR units 25% below median. With a coefficient of -0.0565 (estimate for VMT/vehicle as a function of $/capita) from [3], the VMT reduction is 0.0565*33,000*0.25/12,000 = 4%.

Alternative Literature:

- 50% greater transit school trips than higher income households

Fehr & Peers [6] developed Direct Ridership Models to predict the Bay Area Rapid Transit (BART) ridership activity. One of the objectives of this assessment was to understand the land use and system access factors that influence commute period versus off-peak travel on BART. The analysis focused on the Metropolitan Transportation Commission 2000 Bay Area Travel Survey [7], using the data on household travel behavior to extrapolate relationships between household characteristics and BART mode choice. The study found that regardless of distance from BART, lower income households generate at least 50% higher BART use for school trips than higher income households. More research would be needed to provide more applicable information regarding other types of transit throughout the state.

Other Literature Reviewed:

[4] Bento, Antonio M., Maureen L. Cropper, Ahmed Mushfiq Mobarak, and Katja Vinha. 2005. "The Effects of Urban Spatial Structure on Travel Demand in the United States." *The Review of Economics and Statistics* 87,3: 466-478. (cited in Measure Description section)

[5] San Francisco BMR Program: http://www.ci.sf.ca.us/site/moh_page.asp?id=48083 (p.1) (cited in Discussion section).

[6] Fehr & Peers. *Access BART*. 2006.

[7] BATS. 2000. 2000 Bay Area Travel Survey.

3.1.7 Orient Project Toward Non-Auto Corridor

Range of Effectiveness: Grouped strategy. [See LUT-3]

Measure Description:

A project that is designed around an existing or planned transit, bicycle, or pedestrian corridor encourages alternative mode use. For this measure, the project is oriented towards a planned or existing transit, bicycle, or pedestrian corridor. Setback distance is minimized.

The benefits of Orientation toward Non-Auto Corridor have not been sufficiently quantified in the existing literature. This measure is most effective when applied in combination of multiple design elements that encourage this use. There is not sufficient evidence that this measure results in non-negligible trip reduction unless combined with measures described elsewhere in this report, including neighborhood design, density and diversity of development, transit accessibility and pedestrian and bicycle network improvements. Therefore, the trip reduction percentages presented below should be used only as reasonableness checks. They may be used to assess whether, when applied to projects oriented toward non-auto corridors, analysis of all of those other development design factors presented in this report produce trip reductions at least as great as the percentages listed below.

Measure Applicability:

- Urban or suburban context; may be applicable in a master-planned rural community
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 0.25 – 0.5% reduction in vehicle miles traveled (VMT)

The Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions attributes 0.5% reduction for a project oriented towards an *existing* corridor. A 0.25% reduction is attributed for a project oriented towards a *planned* corridor. The planned transit, bicycle, or pedestrian corridor must be in a General Plan, Community Plan, or similar plan.

Alternate:

- 0.5% reduction in VMT per 1% improvement in transit frequency
- 0.5% reduction in VMT per 10% increase in transit ridership

The *Center for Clean Air Policy (CCAP) Guidebook* [2] attributes a 0.5 % reduction per 1% improvement in transit frequency. Based on a case study presented in the CCAP report, a 10% increase in transit ridership would result in a 0.5% reduction. (This information is based on a TIAX review for SMAQMD).

The sources cited above reflect existing guidance rather than empirical studies.

Alternative Literature References:

[1] Sacramento Metropolitan Air Quality Management District (SMAQMD). "Recommended Guidance for Land Use Emission Reductions." http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf

[2] Center for Clean Air Policy (CCAP). *Transportation Emission Guidebook*. http://www.ccap.org/safe/guidebook/guide_complete.html
TIAX Results of 2005 Literature Search Conducted by TIAX on behalf of SMAQMD

Other Literature Reviewed:

None

3.1.8 Locate Project near Bike Path/Bike Lane

Range of Effectiveness: Grouped strategy. [See LUT-4]

Measure Description:

A Project that is designed around an existing or planned bicycle facility encourages alternative mode use. The project will be located within 1/2 mile of an existing Class I path or Class II bike lane. The project design should include a comparable network that connects the project uses to the existing offsite facilities.

This measure is most effective when applied in combination of multiple design elements that encourage this use. Refer to Increase Destination Accessibility (LUT-4) strategy. The benefits of Proximity to Bike Path/Bike Lane are small as a standalone strategy. The strategy should be grouped with the Increase Destination Accessibility strategy to increase the opportunities for multi-modal travel.

Measure Applicability:

- Urban or suburban context; may be applicable in a rural master planned community
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 0.625% reduction in vehicle miles traveled (VMT)

As a rule of thumb, the *Center for Clean Air Policy (CCAP) Guidebook* [1] attributes a 1% to 5% reduction associated with comprehensive bicycle programs. Based on the CCAP guidebook, the TIAX report allots 2.5% reduction for all bicycle-related measures and a 1/4 of that for this measure alone. (This information is based on a TIAX review for SMAQMD).

Alternative Literature References:

[1] Center for Clean Air Policy (CCAP). *Transportation Emission Guidebook*. http://www.ccap.org/safe/guidebook/guide_complete.html; TIAX Results of 2005 Literature Search Conducted by TIAX on behalf of SMAQMD.

Other Literature Reviewed:

None

3.1.9 Improve Design of Development

Range of Effectiveness: 3.0 – 21.3% vehicle miles traveled (VMT) reduction and therefore 3.0-21.3% reduction in GHG emissions.

Measure Description:

The project will include improved design elements to enhance walkability and connectivity. Improved street network characteristics within a neighborhood include street accessibility, usually measured in terms of average block size, proportion of four-way intersections, or number of intersections per square mile. Design is also measured in terms of sidewalk coverage, building setbacks, street widths, pedestrian crossings, presence of street trees, and a host of other physical variables that differentiate pedestrian-oriented environments from auto-oriented environments.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Number of intersections per square mile

Mitigation Method:

$$\% \text{ VMT Reduction} = \text{Intersections} * B$$

Where

Intersections = Percentage increase in intersections versus a typical ITE suburban development

$$= \frac{\text{Intersections per square mile of project} - \text{Intersections per square mile of typical ITE suburban development}}{\text{Intersections per square mile of typical ITE suburban development}}$$

$$= \frac{\text{Intersections per square mile of project} - 36}{36}$$

See Appendix C for detail [not to exceed 500% increase]

B = Elasticity of VMT with respect to percentage of intersections (0.12 from [1])

Assumptions:

Data based upon the following references:

[1] Ewing, R., and Cervero, R., "Travel and the Built Environment - A Meta-Analysis." *Journal of the American Planning Association*, <to be published> (2010). Table 4.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[43]
CO_2e	3.0 – 21.3% of running
PM	3.0 – 21.3% of running
CO	3.0 – 21.3% of running
NOx	3.0 – 21.3% of running
SO_2	3.0 – 21.3% of running
ROG	1.8 – 12.8% of total

Discussion:

The VMT reductions for this strategy are based on changes in intersection density versus the standard suburban intersection density in North America. This standard density is used as a baseline to mirror the density reflected in the *ITE Trip Generation Manual*, which is the baseline method for determining VMT.

The calculations in the Example section look at a low and high range of intersection densities. The low range is simply a slightly higher density than the typical ITE

[43] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

development. The high range uses an average intersection density of mixed use/transit-oriented development sites (TOD Site surveys in the Bay Area for *Candlestick-Hunters Point Phase II TIA,* Fehr & Peers, 2009).

There are two separate maxima noted in the fact sheet: a cap of 500% on the allowable percentage increase of intersections per square mile (variable A) and a cap of 30% on % VMT reduction. The rationale for the 500% cap is that there are diminishing returns to any change in environment. For example, it is reasonably doubtful that increasing intersection density by a factor of six instead of five would produce any additional change in travel behavior. The purpose for the 30% cap is to limit the influence of any single environmental factor (such as design). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, etc.) will show more of a reduction than relying on improvements from a single land use factor.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (45 intersections per square mile) = (45 – 36) / 36 * 0.12 = 3.0%
- High Range % VMT Reduction (100 intersections per square mile) = (100 – 36) / 36 * 0.12 = 21.3%

Preferred Literature:

- -0.12 = elasticity of VMT with respect to design (intersection/street density)
- -0.12 = elasticity of VMT with respect to design (% of 4-way intersections)

Ewing and Cervero's [1] synthesis showed a strong relationship of VMT to design elements, second only to destination accessibility. The weighted average elasticity of VMT to intersection/street density was -0.12 (looking at six studies). The weighted average elasticity of VMT to percentage of 4-way intersections was -0.12 (looking at four studies, of which one controlled for self-selection[44]).

Alternative Literature:

Alternate:

- 2-19% reduction in VMT

[44] Self selection occurs when residents or employers that favor travel by non-auto modes choose locations where this type of travel is possible. They are therefore more inclined to take advantage of the available options than a typical resident or employee might otherwise be.

Growing Cooler [2] looked at various reports which studied the effect of site design on VMT, showing a range of 2-19% reduction in VMT. In each case, alternative development plans for the same site were compared to a baseline or trend plan. Results suggest that VMT and CO_2 per capita decline as site density increases as well as the mix of jobs, housing, and retail uses become more balanced. *Growing Cooler* notes that the limited number of studies, differences in assumptions and methodologies, and variability of results make it difficult to generalize.

Alternate:

- 3 – 17% shift in mode share from auto to non-auto

The Marshall and Garrick paper [3] analyzes the differences in mode shares for grid and non-grid ("tree") neighborhoods. For a city with a tributary tree street network, a neighborhood with a tree network had auto mode share of 92% while a neighborhood with a grid network had auto mode share of 89% (3% difference). For a city with a tributary radial street network, a tree neighborhood had auto mode share of 97% while a grid neighborhood had auto mode share of 84% (13% difference). For a city with a grid network, a tree neighborhood had auto mode share of 95% while a grid neighborhood had auto mode share of 78% (17% difference). The research is based on 24 California cities with populations between 30,000 and 100,000.

Alternative Literature References:

[2] Ewing, et al, 2008. Growing Cooler – The Evidence on Urban Development and Climate Change. Urban Land Institute.

[3] Marshall and Garrick, 2009. "The Effect of Street Network Design on Walking and Biking." Submitted to the 89th Annual Meeting of Transportation Research Board, January 2010. (Table 3)

Other Literature Reviewed:

None

3.2 Neighborhood/Site Enhancements

3.2.1 Provide Pedestrian Network Improvements

Range of Effectiveness: 0 - 2% vehicle miles traveled (VMT) reduction and therefore 0 - 2% reduction in GHG emissions.

Measure Description:

Providing a pedestrian access network to link areas of the Project site encourages people to walk instead of drive. This mode shift results in people driving less and thus a reduction in VMT. The project will provide a pedestrian access network that internally links all uses and connects to all existing or planned external streets and pedestrian facilities contiguous with the project site. The project will minimize barriers to pedestrian access and interconnectivity. Physical barriers such as walls, landscaping, and slopes that impede pedestrian circulation will be eliminated.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects
- Reduction benefit only occurs if the project has both pedestrian network improvements on site and connections to the larger off-site network.

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The project applicant must provide information regarding pedestrian access and connectivity within the project and to/from off-site destinations.

Mitigation Method:

Estimated VMT Reduction	Extent of Pedestrian Accommodations	Context
2%	Within Project Site and Connecting Off-Site	Urban/Suburban
1%	Within Project Site	Urban/Suburban
< 1%	Within Project Site and Connecting Off-Site	Rural

Assumptions:

Data based upon the following references:

- Center for Clean Air Policy (CCAP) Transportation Emission Guidebook. http://www.ccap.org/safe/guidebook/guide_complete.html (accessed March 2010)
- 1000 Friends of Oregon (1997) "Making the Connections: A Summary of the LUTRAQ Project" (p. 16): http://www.onethousandfriendsoforegon.org/resources/lut_vol7.html

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[45]
CO_2e	0 - 2% of running
PM	0 - 2% of running
CO	0 - 2% of running
NOx	0 - 2% of running
SO_2	0 - 2% of running
ROG	0 – 1.2% of total

Discussion:

As detailed in the preferred literature section below, the lower range of 1 – 2% VMT reduction was pulled from the literature to provide a conservative estimate of reduction potential. The literature does not speak directly to a rural context, but an assumption was made that the benefits will likely be lower than a suburban/urban context.

Example:

N/A – calculations are not needed.

Preferred Literature:

[45] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

- 1 - 2% reduction in VMT

The Center for Clean Air Policy (CCAP) attributes a 1% reduction in VMT from pedestrian-oriented design assuming this creates a 5% decrease in automobile mode share (e.g. auto split shifts from 95% to 90%). This mode split is based on the Portland Regional Land Use Transportation and Air Quality (LUTRAQ) project. The LUTRAQ analysis also provides the high end of 10% reduction in VMT. This 10% assumes the following features:

– Compact, mixed-use communities
– Interconnected street network
– Narrower roadways and shorter block lengths
– Sidewalks
– Accessibility to transit and transit shelters
– Traffic calming measures and street trees
– Parks and public spaces

Other strategies (development density, diversity, design, transit accessibility, traffic calming) are intended to account for the effects of many of the measures in the above list. Therefore, the assumed effectiveness of the Pedestrian Network measure should utilize the lower end of the 1 - 10% reduction range. If the pedestrian improvements are being combined with a significant number of the companion strategies, trip reductions for those strategies should be applied as well, based on the values given specifically for those strategies in other sections of this report. Based upon these findings, and drawing upon recommendations presented in the alternate literature below, the recommended VMT reduction attributable to pedestrian network improvements, above and beyond the benefits of other measures in the above bullet list, should be 1% for comprehensive pedestrian accommodations within the development plan or project itself, or 2% for comprehensive internal accommodations and external accommodations connecting to off-site destinations.

Alternative Literature:

Alternate:

- Walking is three times more common with enhanced pedestrian infrastructure
- 58% increase in non-auto mode share for work trips

The Nelson\Nygaard [1] report for the City of Santa Monica Land Use and Circulation Element EIR summarized studies looking at pedestrian environments. These studies have found a direct connection between non-auto forms of travel and a high quality pedestrian environment. Walking is three times more common with communities that have pedestrian friendly streets compared to less pedestrian friendly communities. Non-auto mode share for work trips is 49% in a pedestrian friendly community, compared to 31% in an auto-oriented community. Non-auto mode share for non-work trips is 15%, compared to 4% in an auto-oriented community. However, these effects also depend upon other aspects of the pedestrian friendliness being present, which are accounted for separately in this report through land use strategy mitigation measures such as density and urban design.

Alternate:

- 0.5% - 2.0% reduction in VMT

The Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions [2] attributes 1% reduction for a project connecting to *existing* external streets and pedestrian facilities. A 0.5% reduction is attributed to connecting to *planned* external streets and pedestrian facilities (which must be included in a pedestrian master plan or equivalent). Minimizing pedestrian barriers attribute an additional 1% reduction in VMT. These recommendations are generally in line with the recommended discounts derived from the preferred literature above.

Preferred and Alternative Literature Notes:

[1] Nelson\Nygaard, 2010. City of Santa Monica Land Use and Circulation Element EIR Report, Appendix – Santa Monica Luce Trip Reduction Impacts Analysis (p.401). http://www.shapethefuture2025.net/

Nelson\Nygaard looked at the following studies: Anne Vernez Moudon, Paul Hess, Mary Catherine Snyder and Kiril Stanilov (2003), Effects of Site Design on Pedestrian Travel in Mixed Use, Medium-Density Environments, http://www.wsdot.wa.gov/research/reports/fullreports/432.1.pdf; Robert Cervero and Carolyn Radisch (1995), Travel Choices in Pedestrian Versus Automobile Oriented Neighborhoods, http://www.uctc.net/papers/281.pdf;

[2] Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions. (p. 11) http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf

Other Literature Reviewed:

None

3.2.2 Provide Traffic Calming Measures

Range of Effectiveness: 0.25 – 1.00% vehicle miles traveled (VMT) reduction and therefore 0.25 – 1.00% reduction in GHG emissions.

Measure Description:

Providing traffic calming measures encourages people to walk or bike instead of using a vehicle. This mode shift will result in a decrease in VMT. Project design will include pedestrian/bicycle safety and traffic calming measures in excess of jurisdiction requirements. Roadways will be designed to reduce motor vehicle speeds and encourage pedestrian and bicycle trips with traffic calming features. Traffic calming features may include: marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, roundabouts or mini-circles, on-street parking, planter strips with street trees, chicanes/chokers, and others.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of streets within project with traffic calming improvements
- Percentage of intersections within project with traffic calming improvements

Mitigation Method:

		% of streets with improvements			
		25%	*50%*	*75%*	*100%*
		% VMT Reduction			
% of intersections with improvements	*25%*	**0.25%**	**0.25%**	**0.5%**	**0.5%**
	50%	**0.25%**	**0.5%**	**0.5%**	**0.75%**
	75%	**0.5%**	**0.5%**	**0.75%**	**0.75%**
	100%	**0.5%**	**0.75%**	**0.75%**	**1%**

Assumptions:

Data based upon the following references:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.*(p. B-25) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

[2] Sacramento Metropolitan Air Quality Management District (SMAQMD) *Recommended Guidance for Land Use Emission Reductions.* (p.13) http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[46]
CO_2e	0.25 – 1.00% of running
PM	0.25 – 1.00% of running
CO	0.25 – 1.00% of running
NOx	0.25 – 1.00% of running
SO_2	0.25 – 1.00% of running
ROG	0.15 – 0.6% of total

Discussion:

The table above allows the Project Applicant to choose a range of street and intersection improvements to determine an appropriate VMT reduction estimate. The Applicant will look at the rows on the left and choose the percent of intersections within

[46] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

the project which will have traffic calming improvements. Then, the Applicant will look at the columns along the top and choose the percent of streets within the project which will have traffic calming improvements. The intersection cell of the row and column selected in the matrix is the VMT reduction estimate.

Though the literature provides some difference between a suburban and urban context, the difference is small and thus a conservative estimate was used to be applied to all contexts. Rural context is not specifically discussed in the literature but is assumed to have similar impacts.

For a low range, a project is assumed to have 25% of its streets with traffic calming improvements and 25% of its intersections with traffic calming improvements. For a high range, 100% of streets and intersections are assumed to have traffic calming improvements

Example:

N/A - No calculations needed.

Preferred Literature:

- -0.03 = elasticity of VMT with respect to a pedestrian environment factor (PEF)
- 1.5% - 2.0% reduction in suburban VMT
- 0.5% - 0.6% reduction in urban VMT

Moving Cooler [1] looked at Ewing's synthesis elasticity from the Smart Growth INDEX model (-0.03) to estimate VMT reduction for a suburban and urban location. The estimated reduction in VMT came from looking at the difference between the VMT results for Moving Cooler's strategy of pedestrian accessibility only compared to an aggressive strategy of pedestrian accessibility and traffic calming.

The Sacramento Metropolitan Air Quality Management District (SMAQMD) *Recommended Guidance for Land Use Emission Reductions* [2] attributes 0.25 – 1% of VMT reductions to traffic calming measures. The table above illustrates the range of VMT reductions based on the percent of streets and intersections with traffic calming measures implemented. This range of reductions is recommended because it is generally consistent with the effectiveness ranges presented in the other preferred literature for situations in which the effects of traffic calming are distinguished from the other measures often found to co-exist with calming, and because it provides graduated effectiveness estimates depending on the degree to which calming is implemented.

Alternative Literature:

None

Alternative Literature References:

None

Other Literature Reviewed:

None

3.2.3 Implement a Neighborhood Electric Vehicle (NEV) Network

Range of Effectiveness: 0.5-12.7% vehicle miles traveled (VMT) reduction since Neighborhood Electric Vehicles (NEVs) would result in a mode shift and therefore reduce the traditional vehicle VMT and GHG emissions[47]. Range depends on the available NEV network and support facilities, NEV ownership levels, and the degree of shift from traditional

Measure Description:

The project will create local "light" vehicle networks, such as NEV networks. NEVs are classified in the California Vehicle Code as a "low speed vehicle". They are electric powered and must conform to applicable federal automobile safety standards. NEVs offer an alternative to traditional vehicle trips and can legally be used on roadways with speed limits of 35 MPH or less (unless specifically restricted). They are ideal for short trips up to 30 miles in length. To create an NEV network, the project will implement the necessary infrastructure, including NEV parking, charging facilities, striping, signage, and educational tools. NEV routes will be implemented throughout the project and will double as bicycle routes.

Measure Applicability:

- Urban, suburban, and rural context
- Small citywide or large multi-use developments
- Appropriate for mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

[47] Transit vehicles may also result in increases in emissions that are associated with electricity production or fuel use. The Project Applicant should consider these potential additional emissions when estimating mitigation for these measures.

Inputs:

The following information needs to be provided by the Project Applicant:

- low vs. high penetration

Mitigation Method:

% VMT reduction = Pop * Number * NEV

Where

Penetration	=	Number of NEVs per household (0.04 to 1.0 from [1])
NEV	=	VMT reduction rate per household (12.7% from [2])

Assumptions:

Data based upon the following reference:

[1] City of Lincoln, MHM Engineers & Surveyors, *Neighborhood Electric Vehicle Transportation Program Final Report*, Issued 04/05/05
[2] City of Lincoln, *A Report to the California Legislature as required by Assembly Bill 2353, Neighborhood Electric Vehicle Transportation Plan Evaluation,* January 1, 2008.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[48]
CO_2e	0.5 – 12.7% of running
PM	0.5 – 12.7% of running
CO	0.5 – 12.7%of running
NOx	0.5 – 12.7% of running
SO_2	0.5 – 12.7% of running
ROG	0.3 – 7.6% of total

Discussion:

The estimated number of NEVs per household may vary based on what the project estimates as a penetration rate for implementing an NEV network. Adjust according to project characteristics. The estimated reduction in VMT is for non-NEV miles traveled. The calculations below assume that NEV miles traveled replace regular vehicle travel.

[48] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

This may not be the case and the project should consider applying an appropriate discount rate on what percentage of VMT is actually replaced by NEV travel..

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (low penetration) = 0.04 * 12.7% = 0.5%
- High Range % VMT Reduction (high penetration) = 1.0 * 12.7% = 12.7%

Preferred Literature:

- 12.7% reduction in VMT per household
- Penetration rates: 0.04 to 1 NEV / household

The NEV Transportation Program plans to implement the following strategies: charging facilities, striping, signage, parking, education on NEV safety, and NEV/bicycle lines throughout the community. . One estimate of current NEV ownership reported roughly 600 NEVs in the city of Lincoln in 2008[49]. With current estimated households of ~13,500[50], a low estimate of NEV penetration would be 0.04 NEV per household. A high NEV penetration can be estimated at 1 NEV per household. The 2007 survey of NEV users in Lincoln revealed an average use of about 3,500 miles per year [2]. With an estimated annual 27,500 VMT/household[51], this results in a 12.7% reduction in VMT per household.

Alternative Literature:

- 0.5% VMT reduction for neighborhoods with internal NEV connections
- 1% VMT reduction for internal and external connections to surrounding neighborhoods
- 1.5% VMT reduction for internal NEV connections and connections to other existing NEV networks serving all other types of uses.

The Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions notes that current studies show NEVs do not replace gas-fueled vehicles as the primary vehicle. For the purpose

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[49] Lincoln, California: A NEV-Friendly Community, Bennett Engineering, the City of Lincoln, and LincolnNEV, August 28, 2008 - http://electrickmotorsports.com/news.php

[50] SACOG Housing Estimates Statistics (http://www.sacog.org/about/advocacy/pdf/fact-sheets/HousingStats.pdf). Linearly interpolated 2008 household numbers between 2005 and 2035 projections.

[51] SACOG SACSim forecasts for VMT per household at 75.4 daily VMT per household * 365 days = 27521 annual VMT per household

of providing incentives for developers to promote NEV use, a project will receive the above listed VMT reductions for implementation.

Alternative Literature Reference:

[1] Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions. (p. 21) http://www.airquality.org/ceqa/GuidanceLUEmissionReductions.pdf

Other Literature Reviewed:

None

3.2.4 Create Urban Non-Motorized Zones

Range of Effectiveness: Grouped strategy. [See SDT-1]

Measure Description:

The project, if located in a central business district (CBD) or major activity center, will convert a percentage of its roadway miles to transit malls, linear parks, or other non-motorized zones. These features encourage non-motorized travel and thus a reduction in VMT.

This measure is most effective when applied with multiple design elements that encourage this use. Refer to Pedestrian Network Improvements (SDT-1) strategy for ranges of effectiveness in this category. The benefits of Urban Non-Motorized Zones alone have not been shown to be significant.

Measure Applicability:

- Urban context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 0.01 – 0.2% annual Vehicle Miles Traveled (VMT) reduction

Moving Cooler [1] assumes 2 – 6% of U.S. CBDs/activity centers will convert to non-motorized zones for the purpose of calculating the potential impact. At full implementation, this would result in a range of CBD/activity center annual VMT reduction of 0.07-0.2% and metro VMT reduction of 0.01-0.03%.

Alternate:

Pucher, Dill, and Handy (2010) [2] note several international case studies of urban non-motorized zones. In Bologna, Italy, vehicle traffic declined by 50%, and 8% of those arriving in the CBD came by bicycle after the conversion. In Lubeck, Germany, of those who used to drive, 12% switched to transit, walking, or bicycling with the conversion. In Aachen, Germany, car travel declined from 44% to 36%, but bicycling stayed constant at 3%

Notes:

No literature was identified that quantifies the benefits of this strategy at a smaller scale.

Alternative Literature References:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

[2] Pucher J., Dill, J., and Handy, S. *Infrastructure, Programs and Policies to Increase Bicycling: An International Review.* February 2010. *Preventive Medicine 50 (2010) S106–S125.* http://policy.rutgers.edu/faculty/pucher/Pucher_Dill_Handy10.pdf

Other Literature Reviewed:

None

3.2.5 Incorporate Bike Lane Street Design (on-site)

Range of Effectiveness: Grouped strategy. [See LUT-9]

Measure Description:

The project will incorporate bicycle lanes, routes, and shared-use paths into street systems, new subdivisions, and large developments. These on-street bike accommodations will be created to provide a continuous network of routes, facilitated with markings and signage. These improvements can help reduce peak-hour vehicle trips by making commuting by bike easier and more convenient for more people. In addition, improved bicycle facilities can increase access to and from transit hubs, thereby expanding the “catchment area” of the transit stop or station and increasing ridership. Bicycle access can also reduce parking pressure on heavily-used and/or heavily-subsidized feeder bus lines and auto-oriented park-and-ride facilities.

Refer to Improve Design of Development (LUT-9) strategy for overall effectiveness levels. The benefits of Bike Lane Street Design are small and should be grouped with the Improve Design of Development strategy to strengthen street network characteristics and enhance multi-modal environments.

Measure Applicability:

- Urban and suburban context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 1% increase in share of workers commuting by bicycle (for each additional mile of bike lanes per square mile)

Dill and Carr (2003) [1] showed that each additional mile of Type 2 bike lanes per square mile is associated with a 1% increase in the share of workers commuting by bicycle. Note that increasing by 1 mile is significant compared to the current average of 0.34 miles per square mile. Also, an increase in 1% in share of bicycle commuters would double the number of bicycle commuters in many areas with low existing bicycle mode share.

Alternate:

- 0.05 – 0.14% annual greenhouse gas (GHG) reduction
- 258 – 830% increase in bicycle community

Moving Cooler [2], based off of a national baseline, estimates 0.05% annual reduction in GHG emissions and 258% increase in bicycle commuting assuming 2 miles of bicycle lanes per square mile in areas with density > 2,000 persons per square mile. For 4 miles of bicycle lanes, estimates 0.09% GHG reductions and 449% increase in bicycle commuting. For 8 miles of bicycle lanes, estimates 0.14% GHG reductions and 830% increase in bicycle commuting. Companion strategies assumed include bicycle parking at commercial destinations, busses fitted with bicycle carriers, bike accessible rapid transit lines, education, bicycle stations, end-trip facilities, and signage.

Alternate:

- 0.075% increase in bicycle commuting with each mile of bikeway per 100,000 residents

A before-and-after study by Nelson and Allen (1997) [3] of bicycle facility implementation found that each mile of bikeway per 100,000 residents increases bicycle commuting 0.075%, all else being equal.

Alternative Literature References:

[1] Dill, Jennifer and Theresa Carr (2003). "Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Tem, Commuters Will Use Them – Another Look." *TRB 2003 Annual Meeting CD-ROM*.

[2] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

[3] Nelson, Arthur and David Allen (1997). "If You Build Them, Commuters Will Use Them; Cross-Sectional Analysis of Commuters and Bicycle Facilities." *Transportation Research Record 1578.*

Other Literature Reviewed:

None

3.2.6 Provide Bike Parking in Non-Residential Projects

Range of Effectiveness: Grouped strategy. [See LUT-9]

Measure Description:

A non-residential project will provide short-term and long-term bicycle parking facilities to meet peak season maximum demand. Refer to Improve Design of Development (LUT-9) strategy for overall effectiveness ranges. Bike Parking in Non-Residential Projects has minimal impacts as a standalone strategy and should be grouped with the Improve Design of Development strategy to encourage bicycling by providing strengthened street network characteristics and bicycle facilities.

Measure Applicability:

- Urban, suburban, and rural contexts
- Appropriate for retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 0.625% reduction in Vehicle Miles Traveled (VMT)

As a rule of thumb, the Center for Clean Air Policy (CCAP) guidebook [1] attributes a 1% to 5% reduction in VMT to the use of bicycles, which reflects the assumption that their use is typically for shorter trips. Based on the *CCAP Guidebook*, the TIAX report allots 2.5% reduction for all bicycle-related measures and a quarter of that for this bicycle parking alone. (This information is based on a TIAX review for Sacramento Metropolitan Air Quality Management District (SMAQMD).)

Alternate:

- 0.05 – 0.14% annual greenhouse gas (GHG) reduction
- 258 – 830% increase in bicycle community

Moving Cooler [2], based off of a national baseline, estimates 0.05% annual reduction in GHG emissions and 258% increase in bicycle commuting assuming 2 miles of bicycle lanes per square mile in areas with density > 2,000 persons per square mile. For 4 miles of bicycle lanes, *Moving Cooler* estimates 0.09% GHG reductions and 449% increase in bicycle commuting. For 8 miles of bicycle lanes, *Moving Cooler* estimates 0.14% GHG reductions and 830% increase in bicycle commuting. Companion strategies assumed include bicycle parking at commercial destinations, busses fitted with bicycle carriers, bike accessible rapid transit lines, education, bicycle stations, end-trip facilities, and signage.

Alternative Literature References:

[1]*Center For Clean Air Policy (CCAP) Transportation Emission Guidebook*. http://www.ccap.org/safe/guidebook/guide_complete.html; Based on results of 2005 literature search conducted by TIAX on behalf of SMAQMD.

[2] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Other Literature Reviewed:

None

3.2.7 Provide Bike Parking with Multi-Unit Residential Projects

Range of Effectiveness: Grouped strategy. [See LUT-9]

Measure Description:

Long-term bicycle parking will be provided at apartment complexes or condominiums without garages. Refer to Improve Design of Development (LUT-9) strategy for effectiveness ranges in this category. The benefits of Bike Parking with Multi-Unit Residential Projects have no quantified impacts and should be grouped with the Improve Design of Development strategy to encourage bicycling by providing strengthened street network characteristics and bicycle facilities.

Measure Applicability:

- Urban, suburban, or rural contexts
- Appropriate for residential projects

Alternative Literature:

No literature was identified that specifically looks at the quantitative impact of including bicycle parking at multi-unit residential sites.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.2.8 Provide Electric Vehicle Parking

Range of Effectiveness: Grouped strategy. [See SDT-3]

Measure Description:

This project will implement accessible electric vehicle parking. The project will provide conductive/inductive electric vehicle charging stations and signage prohibiting parking for non-electric vehicles. Refer to Neighborhood Electric Vehicle Network (SDT-3) strategy for effectiveness ranges in this category. The benefits of Electric Vehicle Parking may be quantified when grouped with the use of electric vehicles and or Neighborhood Electric Vehicle Network.

Measure Applicability:

- Urban or suburban contexts
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

No literature was identified that specifically looks at the quantitative impact of implementing electric vehicle parking.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.2.9 Dedicate Land for Bike Trails

Range of Effectiveness: Grouped strategy. [See LUT-9]

Measure Description:

Larger projects may be required to provide for, contribute to, or dedicate land for the provision of off-site bicycle trails linking the project to designated bicycle commuting routes in accordance with an adopted citywide or countywide bikeway plan.

Refer to Improve Design of Development (LUT-9**)** strategy for ranges of effectiveness in this category. The benefits of Land Dedication for Bike Trails have not been quantified and should be grouped with the Improve Design of Development strategy to strengthen street network characteristics and improve connectivity to off-site bicycle networks.

Measure Applicability:

- Urban, suburban, or rural contexts
- Appropriate for large residential, retail, office, mixed use, and industrial projects

Alternative Literature:

No literature was identified that specifically looks at the quantitative impact of implementing land dedication for bike trails.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.3 Parking Policy/Pricing

3.3.1 Limit Parking Supply

Range of Effectiveness: 5 – 12.5% vehicle miles travelled (VMT) reduction and therefore 5 – 12.5% reduction in GHG emissions.

Measure Description:

The project will change parking requirements and types of supply within the project site to encourage “smart growth” development and alternative transportation choices by project residents and employees. This will be accomplished in a multi-faceted strategy:

- Elimination (or reduction) of minimum parking requirements[52]
- Creation of maximum parking requirements
- Provision of shared parking

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects
- Reduction can be counted only if spillover parking is controlled (via residential permits and on-street market rate parking) [See PPT-5 and PPT-7]

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- ITE parking generation rate for project site
- Actual parking provision rate for project site

[52] This may require changes to local ordinances and regulations.

Mitigation Method:

$$\% \text{ VMT Reduction} = \frac{\text{Actual parking provision} - \text{ITE parking generation rate}}{\text{ITE parking generation rate}} \times 0.5$$

Assumptions:

Data based upon the following references:

[1] Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p. 16) http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf

All trips affected are assumed average trip lengths to convert from percentage vehicle trip reduction to VMT reduction (% vehicle trips = %VMT).

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[53]
CO_2e	5 – 12.5% of running
PM	5 – 12.5% of running
CO	5 – 12.5% of running
NOx	5 – 12.5% of running
SO_2	5 – 12.5% of running
ROG	3 – 7.5% of total

Discussion:

The literature suggests that a 50% reduction in conventional parking provision rates (per ITE rates) should serve as a typical ceiling for the reduction calculation. The upper range of VMT reduction will vary based on the size of the development (total number of spaces provided). ITE rates are used as baseline conditions to measure the effectiveness of this strategy.

Though not specifically documented in the literature, the degree of effectiveness of this measure will vary based on the level of urbanization of the project and surrounding areas, level of existing transit service, level of existing pedestrian and bicycle networks and other factors which would complement the shift away from single-occupant vehicle travel.

[53] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis.

Example:

If the ITE parking generation rate for the project is 100 spaces, for a low range a 5% reduction in spaces is assumed. For a high range a 25% reduction in spaces is assumed.

- Low range % VMT Reduction = [(100 - 95)/100] * 0.5 = 2.5%
- High range % VMT Reduction = [(100 - 75)/100] * 0.5 = 12.5%

Preferred Literature:

To develop this model, Nelson\Nygaard [1] used the Institute of Transportation Engineers' *Parking Generation* handbook as the baseline figure for parking supply. This is assumed to be unconstrained demand. Trip reduction should only be credited if measures are implemented to control for spillover parking in and around the project, such as residential parking permits, metered parking, or time-limited parking.

Alternative Literature:

- 100% increase in transit ridership
- 100% increase in transit mode share

According to *TCRP Report 95, Chapter 18* [2], the central business district of Portland, Oregon implemented a maximum parking ratio of 1 space per 1,000 square feet of new buildings and implemented surface lot restrictions which limited conditions where buildings could be razed for parking. A "before and after" study was not conducted specifically for the maximum parking requirements and data comes from various surveys and published reports. Based on rough estimates the approximate parking ratio of 3.4 per 1,000 square feet in 1973 (for entire downtown) had been reduce to 1.5 by 1990. Transit mode share increased from 20% to 40%. The increases in transit ridership and mode share are not solely from maximum parking requirements. Other companion strategies, such as market parking pricing and high fuel costs, were in place.

Alternative Literature Sources:

[1] TCRP Report 95, Chapter 18: Parking Management and Supply: Traveler Response to *Transportation System Changes*. (p. 18-6) http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c18.pdf

Other Literature Reviewed:

None

3.3.2 Unbundle Parking Costs from Property Cost

Range of Effectiveness: 2.6 – 13% vehicles miles traveled (VMT) reduction and therefore 2.6 – 13% reduction in GHG emissions.

Measure Description:

This project will unbundle parking costs from property costs. Unbundling separates parking from property costs, requiring those who wish to purchase parking spaces to do so at an additional cost from the property cost. This removes the burden from those who do not wish to utilize a parking space. Parking will be priced separately from home rents/purchase prices or office leases. An assumption is made that the parking costs are passed through to the vehicle owners/drivers utilizing the parking spaces.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects
- Complementary strategy includes Workplace Parking Pricing. Though not required, implementing workplace parking pricing ensures the market signal from unbundling parking is transferred to the employee.

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Monthly parking cost for project site

Mitigation Method:

% Reduction in VMT = Change in vehicle cost * elasticity * A

Where:

- -0.4 = elasticity of vehicle ownership with respect to total vehicle costs (lower end per VTPI)
- Change in vehicle cost = monthly parking cost * (12 / $4,000), with $4,000 representing the annual vehicle cost per VTPI [1]
- A: 85% = adjustment from vehicle ownership to VMT (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Victoria Transport Policy Institute, *Parking Requirement Impacts on Housing Affordability;* http://www.vtpi.org/park-hou.pdf; January 2009; accessed March 2010. (Annual/monthly parking fees estimated by VTPI in 2009) (p. 8, Table 3)

- For the elasticity of vehicle ownership, VTPI cites Phil Goodwin, Joyce Dargay and Mark Hanly (2003), *Elasticities Of Road Traffic And Fuel Consumption With Respect To Price And Income: A Review*, ESRC Transport Studies Unit, University College London (www.transport.ucl.ac.uk), commissioned by the UK Department of the Environment, Transport and the Regions (now UK Department for Transport); J.O. Jansson (1989), "Car Demand Modeling and Forecasting," *Journal of Transport Economics and Policy*, May 1989, pp. 125-129; Stephen Glaister and Dan Graham (2000), *The Effect of Fuel Prices on Motorists*, AA Motoring Policy Unit (www.theaa.com) and the UK Petroleum Industry Association (http://195.167.162.28/policyviews/pdf/effect_fuel_prices.pdf); and Thomas F. Golob (1989), "The Casual Influences of Income and Car Ownership on Trip Generation by Mode", *Journal of Transportation Economics and Policy*, May 1989, pp. 141-162

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[54]
CO_2e	2.6 – 13% of running
PM	2.6 – 13% of running
CO	2.6 – 13% of running

[54] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

NOx	2.6 – 13% of running
SO_2	2.6 – 13% of running
ROG	1.6 – 7.8% of total

Discussion:

As discussed in the preferred literature section, monthly parking costs typically range from $25 to $125. The lower end of the elasticity range provided by VTPI is used here to be conservative.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction = $25* 12 / $4000 * 0.4 * 85% = 2.6%
- High Range % VMT Reduction = $125* 12 / $4000 * 0.4 * 85%= 12.8%

Preferred Literature:

- -0.4 to -1.0 = elasticity of vehicle ownership with respect to total vehicle costs

The above elasticity comes from a synthesis of literature. As noted in the VTPI report [1], a 10% increase in total vehicle costs (operating costs, maintenance, fuel, parking, etc.) reduces vehicle ownership between 4% and 10%. The report, estimating $4,000 in annual costs per vehicle, calculated vehicle ownership reductions from residential parking pricing.

Vehicle Ownership Reductions from Residential Parking Pricing

Annual (Monthly) Parking Fee	-0.4 Elasticity	-0.7 Elasticity	-1.0 Elasticity
$300 ($25)	4%	6%	8%
$600 ($50)	8%	11%	15%
$900 ($75)	11%	17%	23%
$1,200 ($100)	15%	23%	30%
$1,500 ($125)	19%	28%	38%

Alternative Literature:

None

Alternative Literature Notes:

None

Other Literature Reviewed:

None

3.3.3 Implement Market Price Public Parking (On-Street)

Range of Effectiveness: 2.8 – 5.5% vehicle miles traveled (VMT) reduction and therefore 2.8 – 5.5% reduction in GHG emissions.

Measure Description:

This project and city in which it is located will implement a pricing strategy for parking by pricing all central business district/employment center/retail center on-street parking. It will be priced to encourage "park once" behavior. The benefit of this measure above that of paid parking at the project only is that it deters parking spillover from project-supplied parking to other public parking nearby, which undermine the vehicle miles traveled (VMT) benefits of project pricing. It may also generate sufficient area-wide mode shifts to justify increased transit service to the area.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context
- Appropriate for retail, office, and mixed-use projects
- Applicable in a specific or general plan context only
- Reduction can be counted only if spillover parking is controlled (via residential permits)
- Study conducted in a downtown area, and thus should be applied carefully if project is not in a central business/activity center

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Location of project site: low density suburb, suburban center, or urban location

- Percent increase in on-street parking prices (minimum 25% needed)

Mitigation Method:

% VMT Reduction = Park$ * B

Where:

Park$ = Percent increase in on-street parking prices (minimum of 25% increase [1])

B = Elasticity of VMT with respect to parking price (0.11, from [2])

Assumptions:

Data based upon the following references:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-10)
Moving Cooler's parking pricing analysis cited Victoria Transport Policy Institute, *How Prices and Other Factors Affect Travel Behavior* (http://www.vtpi.org/tdm/tdm11.htm#_Toc161022578). The VTPI paper summarized the elasticities found in the Hensher and King paper. David A. Hensher and Jenny King (2001), "Parking Demand and Responsiveness to Supply, Price and Location in Sydney Central Business District," *Transportation Research A*, Vol. 35, No. 3 (www.elsevier.com/locate/tra), March 2001, pp. 177-196.

[2] J. Peter Clinch and J. Andrew Kelly (2003), *Temporal Variance Of Revealed Preference On-Street Parking Price Elasticity*, Department of Environmental Studies, University College Dublin (www.environmentaleconomics.net). (p. 2) http://www.ucd.ie/gpep/research/workingpapers/2004/04-02.pdf As referenced in VTPI: http://www.vtpi.org/tdm/tdm11.htm#_Toc161022578

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[55]
CO_2e	2.8 – 5.5% of running

[55] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

PM	2.8 – 5.5% of running
CO	2.8 – 5.5% of running
NOx	2.8 – 5.5% of running
SO_2	2.8 – 5.5% of running
ROG	1.7 – 3.3% of total

Discussion:

The range of parking price increases should be a minimum of 25% and a maximum of 50%. The minimum is based on Moving Cooler [1] discussions which state that a less than 25% increase would not be a sufficient amount to reduce VMT. The case study [2] looked at a 50% price increase, and thus no conclusions can be made on the elasticities above a 50% increase. This strategy may certainly be implemented at a higher price increase, but VMT reductions should be capped at results from a 50% increase to be conservative.

Example:

Assuming a baseline on-street parking price of $1, sample calculations are provided below:

- Low Range % VMT Reduction (25% increase) = ($1.25 - $1)/$1 * 0.11 = 2.8%
- High Range % VMT Reduction (50% increase) = ($1.50 - $1)/$1 * 0.11 = 5.5%

Preferred Literature:

- -0.11 parking demand elasticity with respect to parking prices

The Clinch & Kelly study [2] of parking meters looked at the impacts of a 50% price increase in the cost of on-street parking. The case study location was a central on-street parking area with a 3-hour time limit and a mix of business and non-business uses. The study concluded the parking increases resulted in an estimated average price elasticity of demand of -0.11, while factoring in parking duration results in an elasticity of -0.2 (cost increases also affect the amount of time cars are parked). Though this study is international (Dublin, Ireland), it represents a solid study of parking meter price increases and provides a conservative estimate of elasticity compared to the alternate literature.

Alternative Literature:

Alternate:

- -0.19 shopper parking elasticity with respect to parking price
- -0.48 commuter parking elasticity with respect to parking price

The *TCRP 95 Chapter 13* [3] report looked at a case study of the city of San Francisco implementing a parking tax on all public and private off-street parking (in 1970). Based on the number of cars parked, the report estimated parking price elasticities of -0.19 to -0.48, an average over a three year period.

Alternate:

- -0.15 VMT elasticity with respect to parking prices (for low density regions)
- -0.47 VMT elasticity with respect to parking prices (for high density regions)

The Moving Cooler analysis assumes a 25 percent increase in on-street parking fees is a starting point sufficient to reduce VMT. Using the elasticities stated above, Moving Cooler estimates an annual percent VMT reduction from 0.42% - 1.14% for a range of regions from a large low density region to a small high density region. The calculations assume that pricing occurs at the urban central business district/employment cent/retail center, one-fourth of all person trips are commute based trips, and approximately 15% of commute trips are to the CBD or regional activity centers.

Alternative Literature References:

[3] TCRP Report 95. *Chapter 13: Parking Pricing and Fees - Traveler Response to Transportation System Changes.* http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c13.pdf. (p.13-42)

Other Literature Reviewed:

None

3.3.4 Require Residential Area Parking Permits

Range of Effectiveness: Grouped strategy. (See PPT-1, PPT-2, and PPT-3)

Measure Description:

This project will require the purchase of residential parking permits (RPPs) for long-term use of on-street parking in residential areas. Permits reduce the impact of spillover parking in residential areas adjacent to commercial areas, transit stations, or other locations where parking may be limited and/or priced. Refer to Parking Supply Limitations (PPT-1), Unbundle Parking Costs from Property Cost (PPT-2), or Market Rate Parking Pricing (PPT-3) strategies for the ranges of effectiveness in these categories. The benefits of Residential Area Parking Permits strategy should be combined with any or all of the above mentioned strategies, as providing RPPs are a key complementary strategy to other parking strategies.

Measure Applicability:

- Urban context
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

- -0.45 = elasticity of vehicle miles traveled (VMT) with respect to price
- 0.08% greenhouse gas (GHG) reduction
- 0.09-0.36% VMT reduction

Moving Cooler [1] suggested residential parking permits of $100-$200 annually. This mitigation would impact home-based trips, which are reported to represent approximately 60% of all urban trips. The range of VMT reductions can be attributed to the type of urban area. VMT reductions for $100 annual permits are 0.09% for large, high-density; 0.12% for large, low-density; 0.12% for medium, high-density; 0.18% for medium, low-density; 0.18% for small, high-density; and 0.12% for small, low-density. VMT reductions for $200 annual permits are 0.18% for large, high-density; 0.24% for large, low-density; 0.24% for medium, high-density; 0.36% for medium, low-density; 0.36% for small, high-density; and 0.24% for small, low-density.

Alternative Literature References:

[1] Cambridge Systematics. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions. Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

3.4 Commute Trip Reduction Programs

3.4.1 Implement Commute Trip Reduction Program - Voluntary

Commute Trip Reduction Program – Voluntary, is a multi-strategy program that encompasses a combination of individual measures described in sections 3.4.3 through 3.4.9. It is presented as a means of preventing double-counting of reductions for individual measures that are included in this strategy. It does so by setting a maximum level of reductions that should be permitted for a combined set of strategies within a voluntary program.

Range of Effectiveness: 1.0 – 6.2% commute vehicle miles traveled (VMT) Reduction and therefore 1.0 – 6.2% reduction in commute trip GHG emissions.

Measure Description:

The project will implement a voluntary Commute Trip Reduction (CTR) program with employers to discourage single-occupancy vehicle trips and encourage alternative modes of transportation such as carpooling, taking transit, walking, and biking. The main difference between a voluntary and a required program is:

- Monitoring and reporting is not required
- No established performance standards (i.e. no trip reduction requirements)

The CTR program will provide employees with assistance in using alternative modes of travel, and provide both “carrots” and “sticks” to encourage employees. The CTR program should include all of the following to apply the effectiveness reported by the literature:

- Carpooling encouragement
- Ride-matching assistance
- Preferential carpool parking
- Flexible work schedules for carpools
- Half time transportation coordinator
- Vanpool assistance
- Bicycle end-trip facilities (parking, showers and lockers)

Other strategies may also be included as part of a voluntary CTR program, though they are not included in the reductions estimation and thus are not incorporated in the estimated VMT reductions. These include: new employee orientation of trip reduction and alternative mode options, event promotions and publications, flexible work schedule for all employees, transit subsidies, parking cash-out or priced parking, shuttles, emergency ride home, and improved on-site amenities.

TRT-1 Commute Trip Reduction

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context, unless large employers exist, and suite of strategies implemented are relevant in rural settings
- Appropriate for retail, office, industrial and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees eligible
- Location of project site: low density suburb, suburban center, or urban location

Mitigation Method:

% VMT Reduction = A * B

Where

A = % reduction in commute VMT (from [1])

B = % employees eligible

Detail:

- A: 5.2% (low density suburb), 5.4% (suburban center), 6.2% (urban) annual reduction in commute VMT (from [1])

Assumptions:

Data based upon the following references:

- Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (Table 5.13) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[56]
CO_2e	1.0 – 6.2% of running
PM	1.0 – 6.2% of running
CO	1.0 – 6.2% of running
NOx	1.0 – 6.2% of running
SO_2	1.0 – 6.2% of running
ROG	0.6 –3.7% of total

Discussion:

This set of strategies typically serves as a complement to the more effective workplace CTR strategies such as pricing and parking cash out.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (low density suburb and 20% eligible) = 5.2% * 0.2 = 1.0%
- High Range % VMT Reduction (urban and 100% eligible) = 6.2% * 1 = 6.2%

Preferred Literature:

- 5.2 - 6.2% commute VMT reduction

Moving Cooler assumes the employer support program will include: carpooling, ride-matching, preferential carpool parking, flexible work schedules for carpools, a half-time transportation coordinator, vanpool assistance, bicycle parking, showers, and locker facilities. The report assigns 5.2% reduction to large metropolitan areas, 5.4% to medium metropolitan areas, and 6.2% to small metropolitan areas.

[56] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Alternative Literature:

Alternate:

- 15-19% reduction in commute vehicle trips

TCRP 95 Draft Chapter 19 [2] looked at a sample of 82 Transportation Demand Management (TDM) programs. Low support TDM programs had a 15% reduction, medium support programs 15.9%, and high support 19%. Low support programs had little employer effort. These programs may include rideshare matching, distribution of transit flyers, but have little employer involvement. With medium support programs, employers were involved with providing information regarding commute options and programs, a transportation coordinator (even if part-time), and assistance for ridesharing and transit pass purchases. With high support programs, the employer was providing most of the possible strategies. The sample of programs should not be construed as a random sample and probably represent above average results.

Alternate:

- 4.16 – 4.76% reduction in commute VMT

The Herzog study [3] compared a group of employees, who were eligible for comprehensive commuter benefits (with financial incentives, services such as guaranteed ride home and carpool matching, and informational campaigns) and general marketing information, to a reference group of employees not eligible for commuter benefits. The study showed a 4.79% reduction in VMT, assuming 75% of the carpoolers were traveling to the same worksite. There was a 4.16% reduction in VMT, assuming only 50% of carpoolers were traveling to the same worksite.

Alternate:

- 8.5% reduction in vehicle commute trips

Employer survey results [4] showed that employees at the surveyed companies made 8.5% fewer vehicle trips to work than had been found in the baseline surveys conducted by large employers under the area's trip reduction regulation (i.e. comparing voluntary program with a mandatory regulation). This implied that the 8.5% reduction is a conservative estimate as it is compared to another trip reduction strategy, rather than comparing to a baseline with no reduction strategies implemented. Another survey also showed that 68% of commuters drove alone to work when their employer did not encourage trip reduction. It revealed that with employer encouragement, the drive-alone rate fell 5 percentage points to 63%.

This strategy assumes a companion strategy of employer encouragement. The literature did not specify what commute options each employer provided as part of the program. Options provided may have ranged from simply providing public transit information to implementing a full TDM program with parking cash out, flex hours, emergency ride home, etc. This San Francisco Bay Area survey worked to determine the extent and impact of the emissions saved through voluntary trip reduction efforts (www.cleanairpartnership.com). It identified 454 employment sites with voluntary trip reduction programs and conducted a selected random survey of the more than 400,000 employees at those sites. The study concluded that employer encouragement makes a significant difference in employees' commute choices.

Alternative Literature References:

[2] Pratt, Dick. Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.

[3] Herzog, Erik, Stacey Bricka, Lucie Audette, and Jeffra Rockwell. 2006. "Do Employee Commuter Benefits Reduce Vehicle Emissions and Fuel Consumption? Results of Fall 2004 Survey of Best Workplaces for Commuters." *Transportation Research Record 1956*, 34-41. (Table 8)

[4] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. (p. 25-28) http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

Other Literature Reviewed:

None

3.4.2 Implement Commute Trip Reduction Program – Required Implementation/Monitoring

Commute Trip Reduction Program – Required, is a multi-strategy program that encompasses a combination of individual measures described in sections 3.4.3 through 3.4.9. It is presented as a means of preventing double-counting of reductions for individual measures that are included in this strategy. It does so by setting a maximum level of reduction that should be permitted for a combined set of strategies within a program that is contractually required of the development sponsors and managers and accompanied by a regular performance monitoring and reporting program.

Range of Effectiveness: 4.2 – 21.0% commute vehicle miles traveled (VMT) reduction and therefore 4.2 – 21.0% reduction in commute trip GHG emissions.

Measure Description:

The jurisdiction will implement a Commute Trip Reduction (CTR) ordinance. The intent of the ordinance will be to reduce drive-alone travel mode share and encourage alternative modes of travel. The critical components of this strategy are:

- Established performance standards (e.g. trip reduction requirements)
- Required implementation
- Regular monitoring and reporting

Regular monitoring and reporting will be required to assess the project's status in meeting the ordinance goals. The project should use existing ordinances, such as those in the cities of Tucson, Arizona and South San Francisco, California, as examples of successful CTR ordinance implementations. The City of Tucson requires employers with 100+ employees to participate in the program. An Alternative Mode Usage (AMU) goal and VMT reduction goal is established and each year the goal is increased. Employers persuade employees to commute via an alternative mode of transportation at least one day a week (including carpooling, vanpooling, transit, walking, bicycling, telecommuting, compressed work week, or alternatively fueled vehicle). The Transportation Demand Management (TDM) Ordinance in South San Francisco requires all non-residential developments that produce 100 average daily vehicle trips or more to meet a 35% non-drive-alone peak hour requirement with fees assessed for non-compliance. Employers have established significant CTR programs as a result.

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context, unless large employers exist, and suite of strategies implemented are relevant in rural settings
- Jurisdiction level only
- Strategies in this case study calculations included:

- ○ Parking cash out
- ○ Employer sponsored shuttles to transit station
- ○ Employer sponsored bus servicing the Bay Area
- ○ Transit subsidies

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees eligible

Mitigation Method:

$$\%\ VMT\ Reduction = A * B$$

Where

A = % shift in vehicle mode share of commute trips (from [1])
B = % employees eligible
C = Adjustment from vehicle mode share to commute VMT

Detail:

- A: 21% reduction in vehicle mode share (from [1])
- C: 1.0 (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Nelson/Nygaard (2008). *South San Francisco Mode Share and Parking Report for Genentech, Inc.*(p. 8)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[57]
CO_2e	4.2 – 21.0% of running
PM	4.2 – 21.0% of running
CO	4.2 – 21.0% of running
NOx	4.2 – 21.0% of running
SO_2	4.2 – 21.0% of running
ROG	2.5 – 12.6% of total

Discussion:

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (20% eligibility) = 21% * 20% = 4.2%
- High Range % VMT Reduction (100% eligibility) = 21% * 100% = 21%

Preferred Literature:

- 21% reduction in vehicle mode share

Genentech, in South San Francisco [1], achieved a 34% non-single-occupancy vehicle (non-SOV) mode share (66% SOV) in 2008. Since 2006 when SOV mode share was 74% (26% non-SOV), there has been a reduction of over 10% in drive alone share. Carpool share was 12% in 2008, compared to 11.57% in 2006. Genentech has a significant TDM program including parking cash out ($4/day), express GenenBus service around the Bay Area, free shuttles to Bay Area Rapid Transit (BART) and Caltrain, and transit subsidies. The Genentech campus surveyed for this study is a large, single-tenant campus. Taking an average transit mode share in a suburban development of 1.3% (NHTS,

[57] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_Stw Travel Survey WkdayRpt.pdf (SCAG, SANDAG, Fresno County)), this is an estimated decrease from 98.7% to 78% vehicle mode share (66% SOV + 12% carpool), a 21% reduction in vehicle mode share.

Alternative Literature:

Alternate:

- 10.7% average annual increase in use of non-SOV commute modes

For the City of Tucson [2], use of alternative commute modes increased 64.3% between 1989 and 1995. Employers integrated several key activities into their TDM plans: disseminating information, developing company policies to support TDM, investing in facility enhancements, conducting promotional campaigns, and offering subsidies or incentives to encourage AMU.

Alternative Literature References:

[2] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. (p. 17-19) http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

Other Literature Reviewed:

None

3.4.3 Provide Ride-Sharing Programs

Range of Effectiveness: 1 – 15% commute vehicle miles traveled (VMT) reduction and therefore 1 - 15% reduction in commute trip GHG emissions.

Measure Description:

Increasing the vehicle occupancy by ride sharing will result in fewer cars driving the same trip, and thus a decrease in VMT. The project will include a ride-sharing program as well as a permanent transportation management association membership and funding requirement. Funding may be provided by Community Facilities, District, or County Service Area, or other non-revocable funding mechanism. The project will promote ride-sharing programs through a multi-faceted approach such as:

- Designating a certain percentage of parking spaces for ride sharing vehicles
- Designating adequate passenger loading and unloading and waiting areas for ride-sharing vehicles
- Providing a web site or message board for coordinating rides

Measure Applicability:

- Urban and suburban context
- Negligible impact in many rural contexts, but can be effective when a large employer in a rural area draws from a workforce in an urban or suburban area, such as when a major employer moves from an urban location to a rural location.
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees eligible

- Location of project site: low density suburb, suburban center, or urban location

Mitigation Method:

% VMT Reduction = Commute * Employee

Where

Commute = % reduction in commute VMT (from [1])
Employee = % employees eligible

Detail:

- Commute: 5% (low density suburb), 10% (suburban center), 15% (urban) annual reduction in commute VMT (from [1])

Assumptions:

Data based upon the following references:

[1] VTPI. *TDM Encyclopedia*. http://www.vtpi.org/tdm/tdm34.htm; Accessed 3/5/2010.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[58]
CO_2e	1 – 15% of running
PM	1 – 15% of running
CO	1 – 15% of running
NOx	1 – 15% of running
SO_2	1 – 15% of running
ROG	0.6 – 9% of total

Discussion:

This strategy is often part of Commute Trip Reduction (CTR) Program, another strategy documented separately (see TRT-1 and TRT-2). The Project Applicant should take care not to double count the impacts.

Example:

Sample calculations are provided below:

[58] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

- Low Range % VMT Reduction (low density suburb and 20% eligible) = 5% * 20% = 1%
- High Range % VMT Reduction (urban and 100% eligible) = 15% * 1 = 15%

Preferred Literature:

- 5 – 15% reduction of commute VMT

The *Transportation Demand Management (TDM) Encyclopedia* notes that because rideshare passengers tend to have relatively long commutes, mileage reductions can be relatively large with rideshare. If ridesharing reduces 5% of commute trips it may reduce 10% of vehicle miles because the trips that are reduced are twice as long as average. Rideshare programs can reduce up to 8.3% of commute VMT, up to 3.6% of total regional VMT, and up to 1.8% of regional vehicle trips (Apogee, 1994; TDM Resource Center, 1996). Another study notes that ridesharing programs typically attract 5-15% of commute trips if they offer only information and encouragement, and 10-30% if they also offer financial incentives such as parking cash out or vanpool subsidies (York and Fabricatore, 2001).

Alternative Literature:

- Up to 1% reduction in VMT (if combined with two other strategies)

Per the Nelson\Nygaard report [2], ride-sharing would fall under the category of a minor TDM program strategy. The report allows a 1% reduction in VMT for projects with at least three minor strategies.

Alternative Literature References:

[2] Nelson\Nygaard, 2005. *Crediting Low-Traffic Developments* (p.12). http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf

Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. *A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes*. Technical Memorandum prepared for US EPA, October 2001.

Other Literature Reviewed:

None

3.4.4 Implement Subsidized or Discounted Transit Program

Range of Effectiveness: 0.3 – 20.0% commute vehicle miles traveled (VMT) reduction and therefore a 0.3 – 20.0% reduction in commute trip GHG emissions.

Measure Description:

This project will provide subsidized/discounted daily or monthly public transit passes. The project may also provide free transfers between all shuttles and transit to participants. These passes can be partially or wholly subsidized by the employer, school, or development. Many entities use revenue from parking to offset the cost of such a project.

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of project employees eligible
- Transit subsidy amount
- Location of project site: low density suburb, suburban center, or urban location

Mitigation Method:

$$\% \text{ VMT Reduction} = A * B * C$$

Where

A = % reduction in commute vehicle trips (VT) (from [1])

B = % employees eligible
C = Adjustment from commute VT to commute VMT

Detail:

- A:

	Daily Transit Subsidy			
	$0.75	$1.49	$2.98	$5.96
Worksite Setting	**% Reduction in Commute VT**			
Low density suburb	**1.5%**	**3.3%**	**7.9%**	**20.0%***
Suburban center	**3.4%**	**7.3%**	**16.4%**	**20.0%***
Urban location	**6.2%**	**12.9%**	**20.0%***	**20.0%***
* Discounts greater than 20% will be capped, as they exceed levels recommended by TCRP 95 Draft Chapter 19 and other literature.				

- C: 1.0 (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Nelson\Nygaard, 2010. *City of Santa Monica Land Use and Circulation Element EIR Report, Appendix – Santa Monica Luce Trip Reduction Impacts Analysis* (p.401).

[2] Nelson\Nygaard used the following literature sources: VTPI, Todd Litman, *Transportation Elasticities*, http://www.vtpi.org/elasticities.pdf. Comsis Corporation (1993), *Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience*, USDOT and Institute of Transportation Engineers (www.ite.org); www.bts.gov/ntl/DOCS/474.html.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[59]
CO_2e	0.3 - 20% of running
PM	0.3 - 20% of running
CO	0.3 - 20% of running
NOx	0.3 - 20% of running
SO_2	0.3 - 20% of running
ROG	0. 18 - 12% of total

[59] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Discussion:

This strategy is often part of a Commute Trip Reduction (CTR), another strategy documented separately (see TRT-1 and TRT-2). The Project Applicant should take care not to double count the impacts.

The literature evaluates this strategy in relation to the employer, but keep in mind that this strategy can also be implemented by a school or the development as a whole.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction ($0.75, low density suburb, 20% eligible) = 1.5% * 20% = 0.3%
- High Range % VMT Reduction ($5.96, urban, 100% eligible) = 20% * 100% = 20%

Preferred Literature:

Commute Vehicle Trip Reduction	**Daily Transit Subsidy**			
Worksite Setting	**$0.75**	**$1.49**	**$2.98**	**$5.96**
Low density suburb, rideshare oriented	0.1%	0.2%	0.6%	1.9%
Low density suburb, mode neutral	1.5%	3.3%	7.9%	21.7%*
Low density suburb, transit oriented	2.0%	4.2%	9.9%	23.2%*
Activity center, rideshare oriented	1.1%	2.4%	5.8%	16.5%
Activity center, mode neutral	3.4%	7.3%	16.4%	38.7%*
Activity center, transit oriented	5.2%	10.9%	23.5%*	49.7%*
Regional CBD/Corridor, rideshare oriented	2.2%	4.7%	10.9%	28.3%*
Regional CBD/Corridor, mode neutral	6.2%	12.9%	26.9%*	54.3%*
Regional CBD/Corridor, transit oriented	9.1%	18.1%	35.5%*	64.0%*

* Discounts greater than 20% will be capped, as they exceed levels recommended by *TCRP 95 Draft Chapter 19* and other literature.

Nelson\Nygaard (2010) updated a commute trip reduction table from VTPI Transportation Elasticities to account for inflation since the data was compiled. Data regarding commute vehicle trip reductions was originally from a study conducted by Comsis Corporation and the Institute of Transportation Engineers (ITE).

Alternative Literature:

Alternate:

- 2.4-30.4% commute vehicle trip reduction (VTR)

TCRP 95 Draft Chapter 19 [2] indicates transit subsidies in areas with good transit and restricted parking have a commute VTR of 30.4%; good transit but free parking, a commute VTR of 7.6%; free parking and limited transit 2.4%. Programs with transit subsidies have an average commute VTR of 20.6% compared with an average commute VTR of 13.1% for sites with non-transit fare subsidies.

Alternate:

- 0.03-0.12% annual greenhouse gas (GHG) reduction

Moving Cooler [3] assumed price elasticities of -0.15, -0.2, and -0.3 for lower fares 25%, 33%, and 50%, respectively. *Moving Cooler* assumes average vehicle occupancy of 1.43 and a VMT/trip of 5.12.

Alternative Literature References:

[2] Pratt, Dick. Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.

[3] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Other Literature Reviewed:

None

3.4.5 Provide End of Trip Facilities

Range of Effectiveness: Grouped strategy (see TRT-1 through TRT-3)

Measure Description:

Non-residential projects will provide "end-of-trip" facilities for bicycle riders including showers, secure bicycle lockers, and changing spaces. End-of-trip facilities encourage the use of bicycling as a viable form of travel to destinations, especially to work. End-of-trip facilities provide the added convenience and security needed to encourage bicycle commuting.

End-of-trip facilities have minimal impacts when implemented alone. This strategy's effectiveness in reducing vehicle miles traveled (VMT) depends heavily on the suite of other transit, pedestrian/bicycle, and demand management measures offered. End-of-trip facilities should be grouped with Commute Trip Reduction (CTR) Programs (TRT-1 through TRT-2).

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

- 22% increase in bicycle mode share

The bicycle study documents a multivariate analysis of UK National Travel Survey (Wardman et al. 2007) which found significant impacts on bicycling to work. Compared to base bicycle mode share of 5.8% for work trips, outdoor parking would raise the share to 6.3%, indoor secure parking to 6.6%, and indoor parking plus showers to 7.1%. This results in an estimate 22% increase in bicycle mode share ((7.1%-5.8%)/5.8% = 22%). This suggests that such end of trip facilities have an important impact on the decision to bicycle to work. However, these effects represent reductions in VMT no greater than 0.02% (see Appendix C for calculation detail).

Alternate:

- 2 - 5% reduction in commute vehicle trips

The *Transportation Demand Management (TDM) Encyclopedia*, citing Ewing (1993), documents Sacramento's TDM ordinance. The City allows developers to claim trip reduction credits for worksite showers and lockers of 5% in central business districts, 2% within 660 feet of a transit station, and 2% elsewhere.

Alternate:

- 0.625% reduction in VMT

The *Center for Clean Air Policy (CCAP) Guidebook* attributes a 1% to 5% reduction associated with the use of bicycles, which reflects the assumption that their use is typically for shorter trips. Based on the *CCAP Guidebook*, a 2.5% reduction is allocated for all bicycle-related measures and a 1/4 of that for this measure alone. (This information is based on a TIAX review for SMAQMD).

Alternative Literature References:

[1] Pucher J., Dill, J., and Handy, S. *Infrastructure, Programs and Policies to Increase Bicycling: An International Review.* February 2010. (Table 2, pg. S111) http://policy.rutgers.edu/faculty/pucher/Pucher_Dill_Handy10.pdf

[2] Victoria Transportation Policy Institute (VTPI). *TDM Encyclopedia,* http://www.vtpi.org/tdm/tdm9.htm; accessed 3/4/2010; last update 1/25/2010). VTPI citing: Reid Ewing (1993), "TDM, Growth Management, and the Other Four Out of Five Trips," *Transportation Quarterly*, Vol. 47, No. 3, Summer 1993, pp. 343-366.

[3] Center for Clean Air Policy (CCAP), *CCAP Transportation Emission Guidebook*. http://www.ccap.org/safe/guidebook/guide_complete.html; TIAX Results of 2005 Literature Search Conducted by TIAX on behalf of SMAQMD

Other Literature Reviewed:

None

3.4.6 Encourage Telecommuting and Alternative Work Schedules

Range of Effectiveness: 0.07 – 5.50% commute vehicle miles traveled (VMT) reduction and therefore 0.07 – 5.50% reduction in commute trip GHG emissions.

Measure Description:

Encouraging telecommuting and alternative work schedules reduces the number of commute trips and therefore VMT traveled by employees. Alternative work schedules could take the form of staggered starting times, flexible schedules, or compressed work weeks.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees participating (1 – 25%)
- Strategy implemented: 9-day/80-hour work week, 4-day/40-hour work week, or 1.5 days of telecommuting

Mitigation Method:

% Commute VMT Reduction = Commute

Where

Commute = % reduction in commute VMT (See table below)

	Employee Participation				
	1%	**3%**	**5%**	**10%**	**25%**
	% Reduction in Commute VMT				
9-day/80-hour work week	0.07%	0.21%	0.35%	0.70%	1.75%
4-day/40-hour work week	0.15%	0.45%	0.75%	1.50%	3.75%
telecommuting 1.5 days	0.22%	0.66%	1.10%	2.20%	5.5%

Source: Moving Cooler Technical Appendices, Fehr & Peers
Notes: The percentages from Moving Cooler incorporate a discount of 25% for rebound effects. The percentages beyond 1% employee participation are linearly extrapolated.

Assumptions:

Data based upon the following references:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-54) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[60]
CO_2e	0.07 – 5.50% of running
PM	0.07 – 5.50% of running
CO	0.07 – 5.50% of running
NOx	0.07 – 5.50% of running
SO_2	0.07 – 5.50% of running
ROG	0.04 – 3.3% of total

Discussion:

This strategy is often part of a Commute Trip Reduction Program, another strategy documented separately (see TRT-1 and TRT-2). The Project Applicant should take care not to double count the impacts.

The employee participation rate should be capped at a maximum of 25%. *Moving Cooler* [1] notes that roughly 50% of a typical workforce could participate in alternative

[60] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

work schedules (based on job requirements) and roughly 50% of those would choose to participate.

The 25% discount for rebound effects is maintained to provide a conservative estimate and support the literature results. The project may consider removing this discount from their calculations if deemed appropriate.

Example:

N/A – no calculations are needed.

Preferred Literature:

- 0.07% - 0.22% reduction in commuting VMT

Moving Cooler [1] estimates that if 1% of employees were to participate in a 9 day/80 hour compressed work week, commuting VMT would be reduced by 0.07%. If 1% of employees were to participate in a 4 day/40 hour compressed work week, commuting VMT would reduce by 0.15%; and 1% of employees participating in telecommuting 1.5 days per week would reduce commuting VMT by 0.22%. These percentages incorporate a discounting of 25% to account for rebound effects (i.e., travel for other purposes during the day while not at the work site). The percentages beyond 1% employee participation are linearly extrapolated (see table above).

Alternative Literature:

Alternate:

- 9-10% reduction in VMT for participating employees

As documented in *TCRP 95 Draft Chapter 19* [2], a Denver federal employer's implementation of compressed work week resulted in a 14-15% reduction in VMT for participating employees. This is equivalent to the 0.15% reduction for each 1% participation cited in the preferred literature above. In the Denver example, there was a 65% participation rate out of a total of 9,000 employees. *TCRP 95* states that the compressed work week experiment has no adverse effect on ride-sharing or transit use. Flexible hours have been shown to work best in the presence of medium or low transit availability.

Alternate:

- 0.5 vehicle trips reduced per employee per week
- 13 – 20 VMT reduced per employee per week

As documented in *TCRP 95 Draft Chapter 19* [2], a study of compressed work week for 2,600 Southern California employees resulted in an average reduction of 0.5 trips per week (per participating employee). Participating employees also reduced their VMT by 13-20 miles per week. This translates to a reduction of between 5% and 10% in commute VMT, and so is lower than the 15% reduction cited for Denver government employees.

Alternative Literature References:

[2] Pratt, Dick. Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.

Other Literature Reviewed:

None

3.4.7 Implement Commute Trip Reduction Marketing

Range of Effectiveness: 0.8 – 4.0% commute vehicle miles traveled (VMT) reduction and therefore 0.8 – 4.0% reduction in commute trip GHG emissions.

Measure Description:

The project will implement marketing strategies to reduce commute trips. Information sharing and marketing are important components to successful commute trip reduction strategies. Implementing commute trip reduction strategies without a complementary marketing strategy will result in lower VMT reductions. Marketing strategies may include:

- New employee orientation of trip reduction and alternative mode options
- Event promotions
- Publications

CTR marketing is often part of a CTR program, voluntary or mandatory. CTR marketing is discussed separately here to emphasis the importance of not only providing employees with the options and monetary incentives to use alternative forms of transportation, but to clearly and deliberately promote and educate employees of the various options. This will greatly improve the impact of the implemented trip reduction strategies.

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of project employees eligible (i.e. percentage of employers choosing to participate)

Mitigation Method:

% Commute VMT Reduction = A * B * C

Where

A = % reduction in commute vehicle trips (from [1])
B = % employees eligible
C = Adjustment from commute VT to commute VMT

Detail:

- A: 4% (per [1])
- C: 1.0 (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Pratt, Dick. Personal communication regarding the *Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.* Transit Cooperative Research Program.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[61]
CO_2e	0.8 – 4.0% of running
PM	0.8 – 4.0% of running
CO	0.8 – 4.0% of running
NOx	0.8 – 4.0% of running
SO_2	0.8 – 4.0% of running
ROG	0.5 – 2.4% of total

[61] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Discussion:

The effectiveness of commute trip reduction marketing in reducing VMT depends on which commute reduction strategies are being promoted. The effectiveness levels provided below should only be applied if other programs are offered concurrently, and represent the total effectiveness of the full suite of measures.

This strategy is often part of a CTR Program, another strategy documented separately (see strategy T# E1). Take care not to double count the impacts.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (20% eligible) = 4% * 20% = 0.8%
- High Range % VMT Reduction (100% eligible) = 4% * 100% = 4.0%

Preferred Literature:

- 4-5% commute vehicle trips reduced with full-scale employer support

TCRP 95 Draft Chapter 19 notes the average empirically-based estimate of reductions in vehicle trips for full-scale, site-specific employer support programs alone is 4-5%. This effectiveness assumes there are alternative commute modes available which have on-going employer support. For a program to receive credit for such outreach and marketing efforts, it should contain guarantees that the program will be maintained permanently, with promotional events delivered regularly and with routine performance monitoring.

Alternative Literature:

- 5-15% reduction in commute vehicle trips
- 3% increase in effectiveness of marketed transportation demand management (TDM) strategies

VTPI [2] notes that providing information on alternative travel modes by employers was one of the most important factors contributing to mode shifting. One study (Shadoff,1993) estimates that marketing increases the effectiveness of other TDM strategies by up to 3%. Given adequate resources, marketing programs may reduce vehicle trips by 5-15%. The 5 – 15% range comes from a variety of case studies across the world. U.S. specific case studies include: 9% reduction in vehicle trips with TravelSmart in Portland (12% reduction in VMT), 4-8% reduction in vehicle trips from four cities with individualized marketing pilot projects from the Federal Transit Administration (FTA). Averaged across the four pilot projects, there was a 6.75% reduction in VMT.

Alternative Literature References:

[2] VTPI, TDM Encyclopedia – TDM Marketing; http://www.vtpi.org/tdm/tdm23.htm; accessed 3/5/2010. Table 7 (citing FTA, 2006)

Other Literature Reviewed:

None

3.4.8 Implement Preferential Parking Permit Program

Range of Effectiveness: Grouped strategy (see TRT-1 through TRT-3)

Measure Description:

The project will provide preferential parking in convenient locations (such as near public transportation or building front doors) in terms of free or reduced parking fees, priority parking, or reserved parking for commuters who carpool, vanpool, ride-share or use alternatively fueled vehicles. The project will provide wide parking spaces to accommodate vanpool vehicles.

The impact of preferential parking permit programs has not been quantified by the literature and is likely to have negligible impacts when implemented alone. This strategy should be grouped with Commute Trip Reduction (CTR) Programs (TRT-1 and TRT-2) as a complementary strategy for encouraging non-single occupant vehicle travel.

Measure Applicability:

- Urban, suburban context
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

No quantitative results are available. The case study in the literature implemented a preferential parking permit program as a companion strategy to a comprehensive TDM program. Employees who carpooled at least three times a week qualified to use the spaces.

Alternative Literature References:

[1] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

Other Literature Reviewed:

None

3.4.9 Implement Car-Sharing Program

Range of Effectiveness: 0.4 – 0.7% vehicle miles traveled (VMT) reduction and therefore 0.4 – 0.7% reduction in GHG emissions.

Measure Description:

This project will implement a car-sharing project to allow people to have on-demand access to a shared fleet of vehicles on an as-needed basis. User costs are typically determined through mileage or hourly rates, with deposits and/or annual membership fees. The car-sharing program could be created through a local partnership or through one of many existing car-share companies. Car-sharing programs may be grouped into three general categories: residential- or citywide-based, employer-based, and transit station-based. Transit station-based programs focus on providing the "last-mile" solution and link transit with commuters' final destinations. Residential-based programs work to substitute entire household based trips. Employer-based programs provide a means for business/day trips for alternative mode commuters and provide a guaranteed ride home option.

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Urban or suburban context

Mitigation Method:

% VMT Reduction = A * B / C

Where

A = % reduction in car-share member annual VMT (from the literature)

B = number of car share members per shared car (from the literature)

C = deployment level based on urban or suburban context

Detail:

- A: 37% *(per [1])*
- B: 20 *(per [2])*
- C:

Project setting	1 shared car per X population
Urban	1,000
Suburban	2,000
Source: *Moving Cooler*	

Assumptions:

Data based upon the following references:

[1] Millard-Ball, Adam. "Car-Sharing: Where and How it Succeeds," (2005) Transit Cooperative Research Program (108). P. 4-22

[2] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-52, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[62]
CO_2e	0.4 – 0.7% of running
PM	0.4 – 0.7% of running
CO	0.4 – 0.7% of running
NOx	0.4 – 0.7% of running
SO_2	0.4 – 0.7% of running
ROG	0.24 – 0.42% of total

▪ [62] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Discussion:

Variable C in the mitigation method section represents suggested levels of deployment based on the literature. Levels of deployment may vary based on the characteristics of the project site and the needs of the project residents and employees. This variable should be adjusted accordingly.

The methodology for calculation of VMT reduction utilizes *Moving Cooler's* rule of thumb[63] for the estimated number of car share members per vehicle. An estimate of 50% reduction in car-share member annual VMT (from *Moving Cooler*) was high compared to other literature sources, and *TCRP 108's* 37% reduction was used in the calculations instead.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (suburban) = 37% * 20 / 2000 = 0.4%
- High Range % VMT Reduction (urban) = 37% * 20 / 1000 = 0.7%

Preferred Literature:

- 37% reduction in car-share member VMT

The *TCRP 108* [1] report conducted a survey of car-share members in the United States and Canada in 2004. The results of the survey showed that respondents, on average, drove only 63% of the average mileage they previously drove when not car-share members.

Alternative Literature:

Alternate – Residential or Citywide Based:

- 0.05-0.27% reduction in GHG
- 0.33% reduction in VMT in urban areas

Moving Cooler [2] assumed an aggressive deployment of one car per 2,000 inhabitants of medium-density census tracks and of one car per 1,000 inhabitants of high-density census tracks. This strategy assumes providing a subsidy to a public, private, or nonprofit car-sharing organization and providing free or subsidized lease for usage of public street parking. *Moving Cooler* assumed 20 members per shared car and 50% reduction in VMT per equivalent car. The percent reduction calculated assumes a percentage of urban areas are low, medium, and high density, thus resulting in a lower

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▪ [63] See discussion in Alternative Literature section for "rule of thumb" detail.

than expected reduction in VMT assuming an aggressive deployment in medium and high density areas.

Alternate – Transit Station and Employer Based:

- 23-44% reduction in drive-alone mode share
- Average daily VMT reduction of 18 – 23 miles

TCRP 95 Draft Chapter 19 [3] looked at two demonstrations, CarLink I and CarLink II, in the San Francisco Bay Area. CarLink I ran from January to November 1999. It involved 54 individuals and 12 rental cars stationed at the Dublin-Pleasanton BART station. CarLink II ran from July 2001 to June 2002 and involved 107 individuals and 19 rental cars. CarLink II was based in Palo Alto in conjunction with Caltrain commuter rail service and several employers in the Stanford Research Park. Both CarLink demonstrations were primarily targeted for commuters. CarLink I had a 23% increase in rail mode share, a reduction in drive-alone mode share of 44%, and a decrease in Average Daily VMT of 18 miles. CarLink II had a VMT for round-trip commuters decrease of 23 miles per day and a mode share for drive alone decrease of 22.9%.

Alternate:

- 50% reduction in driving for car-share members

A UC Berkeley study of San Francisco's City CarShare [4] found that members drive nearly 50% less after joining. The study also found that when people joined the car-sharing organization, nearly 30% reduced their household vehicle ownership and two-thirds avoided purchasing another car. The UC Berkeley study found that almost 75% of vehicle trips made by car-sharing members were for social trips such as running errands and visiting friends. Only 25% of trips were for commuting to work or for recreation. Most trips were also made outside of peak periods. Therefore, car-sharing may generate limited impact on peak period traffic.

Alternative Literature References:

[3] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-52, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

[4] Pratt, Dick. *Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies.* Transit Cooperative Research Program.

Cervero, Robert and Yu-Hsin Tsai. *San Francisco City CarShare: Travel-Demand Trends and Second-Year Impacts,* 2005. (Figure 7, p. 35, Table 7, Table 12) http://escholarship.org/uc/item/4f39b7b4

Other Literature Reviewed:

None

3.4.10 Implement a School Pool Program

Range of Effectiveness: 7.2 – 15.8% school vehicle miles traveled (VMT) Reduction and therefore 7.2 – 15.8% reduction in school trip GHG emissions.

Measure Description:

This project will create a ridesharing program for school children. Most school districts provide bussing services to public schools only. SchoolPool helps match parents to transport students to private schools, or to schools where students cannot walk or bike but do not meet the requirements for bussing.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Degree of implementation of SchoolPool Program(moderate to aggressive)

Mitigation Method:

$$\% \text{ VMT Reduction} = \text{Families} * B$$

Where

Families = % families that participate (from [1] and [2])

B = adjustments to convert from participation to daily VMT to annual school VMT

Detail:

- Families: 16% (moderate implementation), 35% (aggressive implementation), (from [1] and [2])
- B: 45% (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. (p. 10, 36-38) http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

[2] Denver Regional Council of Governments (DRCOG). *Survey of Schoolpool Participants, April 2008.* http://www.drcog.org/index.cfm?page=SchoolPool. Obtained from Schoolpool Coordinator, Mia Bemelen.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[64]
CO_2e	7.2 – 15.8% of running
PM	7.2 – 15.8% of running
CO	7.2 – 15.8% of running
NOx	7.2 – 15.8% of running
SO_2	7.2 – 15.8% of running
ROG	4.3 – 9.5% of total

Discussion:

This strategy reflects the findings from only one case study.

Example:

Sample calculations are provided below:

- Low Range % School VMT Reduction (moderate implementation) = 16% * 45% = 7.2%
- High Range % School VMT Reduction (aggressive implementation) = 35% * 45% = 15.8%

[64] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Preferred Literature:

- 7,711 – 18,659 daily VMT reduction

As presented in the TDM Case Studies [1] compilation, the SchoolPool program in Denver saved 18,659 VMT per day in 1995, compared with 7,711 daily in 1994 – a 142% increase. The Denver Regional Council of Governments (DRCOG) [2] enrolled approximately 7,000 families and 32 private schools in the program. The DRCOG staff surveyed a school or interested families to collect home location and schedules of the students. The survey also identified prospective drivers. DRCOG then used carpool-matching software and GIS to match families. These match lists were sent to the parents for them to form their own school pools. 16% of families in the database formed carpools. The average carpool carried 3.1 students.

The SchoolPool program is still in effect and surveys are conducted every few years to monitor the effectiveness of the program. The latest survey report received was in 2008. The report showed that the participant database had increased to over 10,000 families, an 18% increase from 2005. 29% of participants used the list to form a school carpool. This percentage was lower than 35% in 2005 but higher than prior to 2005, at 24%. The average number of families in each carpool ranged from 2.1 prior to 2005 to 2.8 in 2008. The average number of carpool days per week was roughly 4.7. The number of school weeks per year was 39. Per discussions with the Schoolpool Coordinator, a main factor of success was establishing a large database. This was achieved by having parents opt-out of the database versus opting-in.

Alternative Literature:

None

Alternative Literature References:

None

Other Literature Reviewed:

None

3.4.11 Provide Employer-Sponsored Vanpool/Shuttle

Range of Effectiveness: 0.3 – 13.4% commute vehicle miles traveled (VMT) reduction and therefore 0.3 – 13.4% reduction in commute trip GHG emissions.

Measure Description:

This project will implement an employer-sponsored vanpool or shuttle. A vanpool will usually service employees' commute to work while a shuttle will service nearby transit stations and surrounding commercial centers. Employer-sponsored vanpool programs entail an employer purchasing or leasing vans for employee use, and often subsidizing the cost of at least program administration, if not more. The driver usually receives personal use of the van, often for a mileage fee. Scheduling is within the employer's purview, and rider charges are normally set on the basis of vehicle and operating cost.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for office, industrial, and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees eligible

Mitigation Method:

$$\%\ VMT\ Reduction = A * B * C$$

Where

A = % shift in vanpool mode share of commute trips (from [1])

B = % employees eligible

C = adjustments from vanpool mode share to commute VMT

Detail:

- A: 2-20% annual reduction in vehicle mode share (*from [1]*)
  - Low range: low degree of implementation, smaller employers
  - High range: high degree of implementation, larger employers
- C: 0.67 (See Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] TCRP Report 95. *Chapter 5: Vanpools and Buspools - Traveler Response to Transportation System Changes.* http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c5.pdf. (p.5-8)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[65]
CO_2e	0.3 – 13.4% of running
PM	0.3 – 13.4% of running
CO	0.3 – 13.4% of running
NOx	0.3 – 13.4% of running
SO_2	0.3 – 13.4% of running
ROG	0.18 – 8.0% of total

Discussion:

Vanpools are generally more successful with the largest of employers, as large employee counts create the best opportunities for employees to find a suitable number of travel companions to form a vanpool. In the San Francisco Bay Area several large companies (such as Google, Apple, and Genentech) provide regional bus transportation for their employees. No specific studies of these large buspools were identified in the literature. However, the GenenBus serves as a key element of the overall commute trip reduction (CTR) program for Genentech, as discussed in the CTR Program – Required strategy.

This strategy is often part of a CTR Program, another strategy documented separately (see strategy T# E1). Take care not to double count the impacts.

Example:

Sample calculations are provided below:

[65] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

- Low Range % VMT Reduction (low implementation/small employer, 20% eligible) = 2% * 20% * 0.67 = 0.3%
- High Range % VMT Reduction (high implementation/large employer, 100% eligible) = 20% * 100% * 0.67 = 13.4%

Preferred Literature:

- 2-20% vanpool mode share

TCRP Report 95 [1] notes that vanpools can capture 2 to 20% mode share. This range can be attributed to differences in programs, access to high-occupancy vehicle (HOV) lanes, and geographic range. The *TCRP Report* highlights a case study of the 3M Corporation, which with the implementation of a vanpooling program saw drive alone mode share decrease by 10 percentage points and vanpooling mode share increase to 7.8 percent. The *TCRP Report* notes most vanpools programs do best where one-way trip lengths exceed 20 miles, where work schedules are fixed and regular, where employer size is sufficient to allow matching of 5 to 12 people from the same residential area, where public transit is inadequate, and were some congestion or parking problems exist.

Alternative Literature:

In *TDM Case Studies* [2], a case study of Kaiser Permanente Hospital has shown their employer-sponsored shuttle service eliminated 380,100 miles per month, or nearly 4 million miles of travel per year, and four tons of smog precursors annually.

Alternative Literature References:

[2] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

Other Literature Reviewed:

None

3.4.12 Implement Bike-Sharing Programs

Range of Effectiveness: Grouped strategy (see SDT-5 and LUT-9)

Measure Description:

This project will establish a bike sharing program. Stations should be at regular intervals throughout the project site. The number of bike-share kiosks throughout the project area should vary depending on the density of the project and surrounding area. Paris' bike-share program places a station every few blocks throughout the city (approximately 28 bike stations/square mile). Bike-station density should increase around commercial and transit hubs.

Bike sharing programs have minimal impacts when implemented alone. This strategy's effectiveness is heavily dependent on the location and context. Bike-sharing programs have worked well in densely populated areas (examples in Barcelona, London, Lyon, and Paris) with existing infrastructure for bicycling. Bike sharing programs should be combined with **Bike Lane Street Design (SDT-5)** and **Improve Design of Development (LUT-9)**.

Taking evidence from the literature, a 135-300% increase in bicycling (of which roughly 7% are shifting from vehicle travel) results in a negligible impact (around 0.03% vehicle miles traveled (VMT) reduction (see Appendix C for calculations)).

Measure Applicability:

- Urban and suburban-center context only
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Alternative Literature:

Alternate:

The International Review [1] found bike mode share increases:

- from 0.75% in 2005 to 1.76% in 2007 in Barcelona (Romero, 2008) (135% increase)
- From 1% in 2001 to 2.5% in 2007 in Paris (Nadal, 2007; City of Paris, 2007) (150% increase)
- From 0.5% in 1995 to 2% in 2006 in Lyon (Bonnette, 2007; Velo'V, 2009) (300% increase)

London [2] is the only study that reports the breakdown of the prior mode In London: 6% of users reported shifting from driving, 34% from transit, 23% said they would not have travelled (Noland and Ishaque, 2006). Additionally, 68% of the bike trips were for leisure or recreation. Companion strategies included concurrent improvements in bicycle facilities.

The London program was implemented west of Central London in a densely populated area, mainly residential, with several employment centers. A relatively well developed bike network existed, including over 1,000 bike racks. The program implemented 25 locker stations with 70 bikes total.

Alternate:

- 1/3 vehicle trip reduced per day per bicycle (1,000 vehicle trips reduced per day in Lyon)

The Bike Share Opportunities [3] report looks at two case studies of bike-sharing implementation in France. In Lyon, the 3,000 bike-share system shifts 1,000 car trips to bicycle each day. Surveys indicate that 7% of the bike share trips would have otherwise been made by car. Lyon saw a 44% increase in bicycle riding within the first year of their program while Paris saw a 70% increase in bicycle riding and a 5% reduction in car use and congestion within the first year and a half of their program. The Bike Share Opportunities report found that population density is an important part of a successful program. Paris' bike share subscription rates range between 6% and 9% of the total population. This equates to an average of 75,000 rentals per day. The effectiveness of bike share programs at sub-city scales are not addressed in the literature.

Alternative Literature References:

[1] Pucher J., Dill, J., and Handy, S. Infrastructure, Programs and Policies to Increase Bicycling: An International Review. February 2010. (Table 4)

[2] Noland, R.B., Ishaque, M.M., 2006. "Smart Bicycles in an urban area: Evaluation of a pilot scheme in London." *Journal of Public Transportation*. 9(5), 71-95. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.117.8173&rep=rep1&type=pdf#page=76

[3] NYC Department of City Planning, *Bike-Share Opportunities in New York City,* 2009. (p. 11, 14, 24, 68) http://www.nyc.gov/html/dcp/html/transportation/td_bike_share.shtml

Other Literature Reviewed:

None

3.4.13 Implement School Bus Program

Measure Effectiveness Range: 38 – 63% School VMT Reduction and therefore 38 – 63% reduction in school trip GHG emissions[66]

Measure Description:

The project will work with the school district to restore or expand school bus services in the project area and local community.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential and mixed-use projects

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of families expected to use/using school bus program

Mitigation Method:

$$\% \text{ VMT Reduction} = A * B$$

Where

A = % families expected to use/using school bus program

B = adjustments to convert from participation to school day VMT to annual school VMT

[66] Transit vehicles may also result in increases in emissions that are associated with electricity production or fuel use. The Project Applicant should consider these potential additional emissions when estimating mitigation for these measures.

Detail:

- A: a typical range of 50 – 84% (see discussion section)
- B: 75% (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] JD Franz Research, Inc.; *Lamorinda School Bus Program, 2003 Parent Survey, Final Report;* January 2004; obtained from Juliet Hansen, Program Manager. (p. 5)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[67]
CO_2e	38 – 63% of running
PM	38 – 63% of running
CO	38 – 63% of running
NOx	38 – 63% of running
SO_2	38 – 63% of running
ROG	23 – 38% of total

Discussion:

The literature presents a high range of effectiveness showing 84% participation by families. 50% is an estimated low range assuming the project has a minimum utilization goal. Note that the literature presents results from a single case study.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (50% participation) = 50% * 75% = 38%
- High Range % VMT Reduction (85% participation) = 84% * 75% = 63%

Preferred Literature:

- 84% penetration rate
- 2,451 – 2,677 daily vehicle trips reduced
- 441,180 – 481,860 annual vehicle trips reduced

[67] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

The Lamorinda School Bus Program was implemented to reduce traffic congestion in the communities of Lafayette, Orinda, and Moraga, California. In 2003, a parent survey was conducted to determine the extent to which the program diverted or eliminated vehicle trips. This survey covered a representative sample of all parents (not just those signed up for the school bus program). The range of morning trips prevented is 1,266 to 1,382; the range of afternoon trips prevented is 1,185 to 1,295. Annualized, the estimated total trip prevention is between 441,180 to 481,860. 83% of parents surveyed reported that their child usually rides the bus to school in the morning. 84% usually rode the bus back home in the afternoons. The data came from surveys and the results are unique to the location and extent of the program. The report did not indicate the number of school buses in operation during the time of the survey.

Alternative Literature:

None

Alternative Literature References:

None

Other Literature Reviewed:

None

3.4.14 Price Workplace Parking

Range of Effectiveness: 0.1 – 19.7% commute vehicle miles traveled (VMT) reduction and therefore 0.1 -19.7% reduction in commute trip GHG emissions.

Measure Description:

The project will implement workplace parking pricing at its employment centers. This may include: explicitly charging for parking for its employees, implementing above market rate pricing, validating parking only for invited guests, not providing employee parking and transportation allowances, and educating employees about available alternatives.

Though similar to the Employee Parking "Cash-Out" strategy, this strategy focuses on implementing market rate and above market rate pricing to provide a price signal for employees to consider alternative modes for their work commute.

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context
- Appropriate for retail, office, industrial, and mixed-use projects
- Reductions applied only if complementary strategies are in place:
  - Residential parking permits and market rate public on-street parking - to prevent spill-over parking
  - Unbundled parking - is not required but provides a market signal to employers to transfer over the, now explicit, cost of parking to the employees. In addition, unbundling parking provides a price with which employers can utilize as a means of establishing workplace parking prices.

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Location of project site: low density suburb, suburban center, or urban location
- Daily parking charge ($1 - $6)
- Percentage of employees subject to priced parking

Mitigation Method:

% VMT Reduction = A * B

Where

A = Percentage reduction in commute VMT (from [1] and [2])

B = Percent of employees subject to priced parking

Detail:

- A:

Project Location	Daily Parking Charge			
	$1	$2	$3	$6
Low density suburb	0.5%	1.2%	1.9%	2.8%
Suburban center	1.8%	3.7%	5.4%	6.8%
Urban Location	6.9%	12.5%	16.8%	19.7%
Moving Cooler, VTPI, Fehr & Peers. Note: 2009 dollars.				

Assumptions:

Data based upon the following references:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (Table 5.13, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

[2] VTPI, Todd Litman, *Transportation Elasticities,*(Table 15) *http://www.vtpi.org/elasticities.pdf.*

Comsis Corporation (1993), *Implementing Effective Travel Demand Management Measures: Inventory of Measures and Synthesis of Experience*, USDOT and Institute of Transportation Engineers (www.ite.org); www.bts.gov/ntl/DOCS/474.html.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[68]
CO_2e	0.1 – 19.7% of running
PM	0.1 – 19.7% of running
CO	0.1 – 19.7% of running
NOx	0.1 – 19.7% of running
SO_2	0.1 – 19.7% of running
ROG	0.06 – 11.8% of total

Discussion:

Priced parking can result in parking spillover concerns. The highest VMT reductions should be given only with complementary strategies such as parking time limits or neighborhood parking permits are in place in surrounding areas.

Example:

Sample calculations are provided below:

- Low Range % Commute VMT Reduction (low density suburb, $1/day, 20% priced) = 0.5% * 20% = 0.1%
- High Range % Commute VMT Reduction (urban, $6/day, 100% priced) = 19.7% * 100% = 19.7%

Preferred Literature:

The table above (variable A) was calculated using the percent commute VMT reduction from *Moving Cooler* (0.5% - 6.9% reduction for $1/day parking charge). The percentage reductions for $2 - $6 / day parking charges were extrapolated by multiplying the *Moving Cooler* percentages with the ratios from the VTPI table below (percentage increases). For example, to obtain a percent VMT reduction for a $6/day parking charge for a low density suburb, 0.5% * ((36.1%-6.5%) /6.5%) = 2.3%. The methodology was utilized to capture the non-linear effect of parking charges on trip reduction (VTPI) while maintaining a conservative estimate of percent reductions (*Moving Cooler*).

Preferred:

- 0.5-6.9% reduction in commuting VMT
- 0.44-2.07% reduction in greenhouse gas (GHG) emissions

[68] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Moving Cooler Technical Appendices indicate that increasing employee parking costs $1 per day ($0.50 per vehicle for carpool and free for vanpools) can reduce GHG between 0.44% and 2.07% and reduce commuting VMT between 0.5% and 6.9%. The reduction in GHG varies based on how extensive the implementation of the program is. The reduction in commuting VMT differs for type of urban area as shown in the table below. Please note that these numbers are independent of results for employee parking cash-out strategy (discussed in its own fact sheet).

		Percent Change in Commuting VMT					
Strategy	Description	Large Metropolitan (higher transit use)	Large Metropolitan (lower transit use)	Medium Metro (higher)	Medium Metro (lower)	Small Metro (higher)	Small Metro (lower)
Parking Charges	Parking charge of $1/day	6.9%	0.9%	1.8%	0.5%	1.3%	0.5%
Source: *Moving Cooler*							

Preferred:

Commute Vehicle trip reduction	**Daily Parking Charges**			
Worksite Setting	**$0.75**	**$1.49**	**$2.98**	**$5.96**
Suburb	6.5%	15.1%	25.3%*	36.1%*
Suburban Center	12.3%	25.1%*	37.0%*	46.8%*
Central Business District	17.5%	31.8%*	42.6%*	50.0%*
Source: VTPI [2]				

* Discounts greater than 20% should be capped, as they exceed levels recommended by *TCRP 95* and other literature.

The reduction in commute trips varies by parking fee and worksite setting [2]. For daily parking fees between $1.49 and $5.96, worksites set in low-density suburbs could decrease vehicle trips by 6.5-36.1%, worksites set in activity centers could decrease vehicle trips by 12.3-46.8%, and worksites set in regional central business districts could decrease vehicles by 17.5-50%. (Note that adjusted parking fees (from 1993 dollars to 2009 dollars) were used. Adjustments were taken from the *Santa Monica General Plan EIR Report, Appendix*, Nelson\Nygaard).

Alternative Literature:

Alternate:

- 1 percentage point reduction in auto mode share
- 12.3% reduction in commute vehicle trips

TCRP 95 Draft Chapter 19 [4] found that an increase of $8 per month in employee parking charges was necessary to decrease employee SOV mode split rates by one percentage point. *TCRP 95* compared 82 sites with TDM programs and found that programs with parking fees have an average commute vehicle trip reduction of 24.6%, compared with 12.3% for sites with free parking.

Alternate:

- 1% reduction in VMT ($1 per day charge)
- 2.6% reduction in VMT ($3 per day charge)

The Deakin, et al. report [5] for the California Air Resources Board (CARB) analyzed transportation pricing measures for the Los Angeles, Bay Area, San Diego, and Sacramento metropolitan areas.

Alternative Literature References:

[4] Pratt, Dick. Personal Communication Regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies. (Table 19-9)

[5] Deakin, E., Harvey, G., Pozdena, R., and Yarema, G., 1996. *Transportation Pricing Strategies for California: An Assessment of Congestion, Emissions, Energy and Equity Impacts.* Final Report. Prepared for California Air Resources Board (CARB), Sacramento, CA (Table 7.2)

Other Literature Reviewed:

None

3.4.15 Implement Employee Parking "Cash-Out"

Range of Effectiveness: 0.6 – 7.7% commute vehicle miles traveled (VMT) reduction and therefore 0.6 – 7.7% reduction in commute trip GHG emissions

Measure Description:

The project will require employers to offer employee parking "cash-out." The term "cash-out" is used to describe the employer providing employees with a choice of forgoing their current subsidized/free parking for a cash payment equivalent to the cost of the parking space to the employer.

Measure Applicability:

- Urban and suburban context
- Not applicable in a rural context
- Appropriate for retail, office, industrial, and mixed-use projects
- Reductions applied only if complementary strategies are in place:
    - Residential parking permits and market rate public on-street parking -to prevent spill-over parking
    - Unbundled parking - is not required but provides a market signal to employers to forgo paying for parking spaces and "cash-out" the employee instead. In addition, unbundling parking provides a price with which employers can utilize as a means of establishing "cash-out" prices.

Baseline Method:

See introduction section.

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage of employees eligible
- Location of project site: low density suburb, suburban center, or urban location

Mitigation Method:

$$\% \text{ VMT Reduction} = A * B$$

Where

A = % reduction in commute VMT (from the literature)
B = % of employees eligible

TRT-15 Commute Trip Reduction

Detail:

- A: Change in Commute VMT: 3.0% (low density suburb), 4.5% (suburban center), 7.7% (urban) change in commute VMT (source: Moving Cooler)

Assumptions:

Data based upon the following references:

- Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (Table 5.13, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[69]
CO_2e	0.6 – 7.7% of running
PM	0.6 – 7.7% of running
CO	0.6 – 7.7% of running
NOx	0.6 – 7.7% of running
SO_2	0.6 – 7.7% of running
ROG	0.36 – 4.62% of running

Discussion:

Please note that these estimates are independent of results for workplace parking pricing strategy (see strategy number T# E5 for more information).

If work site parking is not unbundled, employers cannot utilize this unbundled price as a means of establishing "cash-out" prices. The table below shows typical costs for parking facilities in large urban and suburban areas in the US. This can be utilized as a reference point for establishing reasonable "cash-out" prices. Note that the table does not include external costs to parking such as added congestion, lost opportunity cost of land devoted to parking, and greenhouse gas (GHG) emissions.

	Structured (urban)	Surface (suburban)
Land (Annualized)	$1,089	$215
Construction (Annualized)	$2,171	$326

69 The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

O & M Costs	$575	$345
Annual Total	$3,835	$885
Monthly Costs	$320	$74
Source: VTPI, *Transportation Costs and Benefit Analysis II – Parking Costs*, April 2010 (p.5.4-10)		

Example:
Sample calculations are provided below:

- Low Range % VMT Reduction (low density suburb and 20% eligible) = 3% * 0.2 = 0.6%
- High Range % VMT Reduction (urban and 100% eligible) = 7.7% * 1 = 7.7%

Preferred Literature:
- 0.44% - 2.07% reduction in GHG emissions
- 3.0% - 7.7% reduction in commute VMT

Moving Cooler Technical Appendices indicate that reimbursing "cash-out" participants $1/day can reduce GHG between 0.44% and 2.07% and reduce commuting VMT between 3.0% and 7.7%. The reduction in GHG varies based on how extensive the implementation of the program is. The reduction in commuting VMT differs for type of urban area is shown in the table below.

		Percent Change in Commuting VMT					
Strategy	Description	Large Metropolitan (higher transit use)	Large Metropolitan (lower transit use)	Medium Metro (higher)	Medium Metro (lower)	Small Metro (higher)	Small Metro (lower)
Parking Cash-Out	Subsidy of $1/day	7.7%	3.7%	4.5%	3.0%	4.0%	3.0%

Alternative Literature:
Alternate:
- 2-6% reduction in vehicle trips

VTPI used synthesis data to determine parking cash out could reduce commute vehicle trips by 10-30%. VTPI estimates that the portion of vehicle travel affected by parking cash-out would be about 20% and therefore there would be only about a 2-6% total reduction in vehicle trips attributed to parking cash-out.

Alternate:

- 12% reduction in VMT per year per employee
- 64% increase in carpooling
- 50% increase in transit mode share
- 39% increase in pedestrian/bike share

Shoup looked at eight California firms that complied with California's 1992 parking cash-out law, applicable to employers of 50 or more persons in regions that do not meet the state's clean air standards. To comply, a firm must offer commuters the option to choose a cash payment equal to any parking subsidy offered. Six of companies went beyond compliance and subsidized one or more alternatives to parking (more than the parking subsidy price). The eight companies ranged in size between 120 and 300 employees, and were located in downtown Los Angeles, Century City, Santa Monica, and West Hollywood. Shoup states that an average of 12% fewer VMT per year per employee is equivalent to removing one of every eight cars driven to work off the road.

Alternative Literature Notes:

Litman, T., 2009. "Win-Win Emission Reduction Strategies." Victoria Transport Policy Institute. Website: http://www.vtpi.org/wwclimate.pdf. Accessed March 2010. (p. 5)

Donald Shoup, "Evaluating the Effects of Cashing Out Employer-Paid Parking: Eight Case Studies." *Transport Policy*, Vol. 4, No. 4, October 1997, pp. 201-216. (Table 1, p. 204)

Other Literature Reviewed:

None

3.5 Transit System Improvements

3.5.1 Provide a Bus Rapid Transit System

Range of Effectiveness: 0.02 – 3.2% vehicle miles traveled (VMT) reduction and therefore 0.02 – 3% reduction in GHG emissions.

Measure Description:

The project will provide a Bus Rapid Transit (BRT) system with design features for high quality and cost-effective transit service. These include:

- Grade-separated right-of-way, including bus only lanes (for buses, emergency vehicles, and sometimes taxis), and other Transit Priority measures. Some systems use guideways which automatically steer the bus on portions of the route.
- Frequent, high-capacity service
- High-quality vehicles that are easy to board, quiet, clean, and comfortable to ride.
- Pre-paid fare collection to minimize boarding delays.
- Integrated fare systems, allowing free or discounted transfers between routes and modes.
- Convenient user information and marketing programs.
- High quality bus stations with Transit Oriented Development in nearby areas.
- Modal integration, with BRT service coordinated with walking and cycling facilities, taxi services, intercity bus, rail transit, and other transportation services.

BRT systems vary significantly in the level of travel efficiency offered above and beyond “identity” features and BRT branding. The following effectiveness ranges represent general guidelines. Each proposed BRT should be evaluated specifically based on its characteristics in terms of time savings, cost, efficiency, and way-finding advantages. These types of features encourage people to use public transit and therefore reduce VMT.

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context. Other measures are more appropriate to rural areas, such as express bus service to urban activity centers with park-and-ride lots at system-efficient rural access points.
- Appropriate for specific or general plans

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Existing transit mode share
- Percentage of lines serving Project converting to BRT

The following are optional inputs. Average (default) values are included in the calculations but can be updated to project specificity if desired. Please see Appendix C for calculation detail:

- Average vehicle occupancy

Mitigation Method:

% VMT Reduction = Riders * Mode * Lines * D

Where

Riders = % increase in transit ridership on BRT line (28% from [1])

Mode = Existing transit mode share (see table below)

Lines = Percentage of lines serving project converting to BRT

D = Adjustments from transit ridership increase to VMT (0.67, see Appendix C)

Project setting	Transit mode share
Suburban	1.3%
Urban	4%
Urban Center	17%
Source: NHTS, 2001 http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_StwTravelSurveyWkdayRpt.pdf (Urban – MTC, SACOG. Suburban – SCAG, SANDAG, Fresno County.) Urban Center from San Francisco County Transportation Authority Countywide Transportation Plan, 2000.	

- D: 0.67 (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] FTA, August 2005. "Las Vegas Metropolitan Area Express BRT Demonstration Project", NTD, http://www.ntdprogram.gov/ntdprogram/cs?action=showRegionAgencies&region=9

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[70]
CO_2e	0.02 – 3.2% of running
PM	0.02 – 3.2% of running
CO	0.02 – 3.2% of running
NOx	0.02 – 3.2% of running
SO_2	0.02 – 3.2% of running
ROG	0.012 – 1.9% of total

Discussion:

Increases in transit ridership due to shifts from other lines do not need to be addressed since it is already incorporated in the literature.

In general, transit operational strategies alone are not enough for a large modal shift [2], as evidenced by the low range in VMT reductions. Through case study analysis, the TCRP report [2] observed that strategies that focused solely on improving level of service or quality of transit were unsuccessful at achieving a significant shift. Strategies that reduce the attractiveness of vehicle travel should be implemented in combination to attract a larger shift in transit ridership. The three following factors directly impact the attractiveness of vehicle travel: urban expressway capacity, urban core density, and downtown parking availability.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (suburban,10% of lines) = 28% * 1.3% * 10% * 0.67 = 0.02%

[70] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

- High Range % VMT Reduction (urban, 100% of lines) = 28% * 17% * 100% * 0.67 = 3.2%

Preferred Literature:

- 28% increase in transit ridership in the existing corridor

The FTA study [1] looks at the implementation of the Las Vegas BRT system. The BRT supplemented an existing route along a 7.5 mile corridor. The existing route was scaled back. Total ridership on the corridor (both routes combined) increased 61,704 monthly riders, 28% increase on the existing corridor and 1.4% increase in system ridership. The route represented an increase in 2.1% of system service miles provided.

Alternative Literature:

Alternate:

- 27-84% increase in total transit ridership

Various bus rapid transit systems obtained the following total transit ridership growth: Vancouver 96B (30%), Las Vegas Max (35-40%), Boston Silver Line (84%), Los Angeles (27-42%), and Oakland (66%). VTPI [3] obtained the BRT data from BC Transit's unpublished research. The effectiveness of a BRT strategy depends largely on the land uses the BRT serves and their design and density.

Alternate:

- 50% increase in weekly transit ridership
- 60 – 80% shorter travel time compared to vehicle trip

The Martin Luther King, Jr. East Busway in Pennsylvania opened in 1983 as a separate roadway exclusively for public buses. The busway was 6.8 miles long with six stations. Ridership has grown from 20,000 to 30,000 weekday riders over 10 years. The busway saves commuters significant time compared with driving: 12 minutes versus 30-45 minutes in the AM or an hour in the PM [4].

Alternative Literature References:

[2] Transit Cooperative Research Program. TCRP 27 – Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It (p.47-48). 1997. [cited in discussion section above]

[3] TDM Encyclopedia; Victoria Transport Policy Institute (2010). Bus Rapid Transit; (http://www.vtpi.org/tdm/tdm120.htm); updated 1/25/2010; accessed 3/3/2010.

[4] Transportation Demand Management Institute of the Association for Commuter Transportation. *TDM Case Studies and Commuter Testimonials*. Prepared for the US EPA. 1997. (p.55-56) http://www.epa.gov/OMS/stateresources/rellinks/docs/tdmcases.pdf

3.5.2 Implement Transit Access Improvements

Range of Effectiveness: Grouped strategy. [See TST-3 and TST-4]

Measure Description:

This project will improve access to transit facilities through sidewalk/ crosswalk safety enhancements and bus shelter improvements. The benefits of Transit Access Improvements alone have not been quantified and should be grouped with Transit Network Expansion (TST-3) and Transit Service Frequency and Speed (TST-4).

Measure Applicability:

- Urban, suburban context
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

No literature was identified that specifically looks at the quantitative impact of improving transit facilities as a standalone strategy.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.5.3 Expand Transit Network

Range of Effectiveness: 0.1 – 8.2% vehicle miles travelled (VMT) reduction and therefore 0.1 – 8.2% reduction in GHG emissions[71]

Measure Description:

The project will expand the local transit network by adding or modifying existing transit service to enhance the service near the project site. This will encourage the use of transit and therefore reduce VMT.

Measure Applicability:

- Urban and suburban context
- May be applicable in a rural context but no literature documentation available (effectiveness will be case specific and should be based on specific assessment of levels of services and origins/destinations served)
- Appropriate for specific or general plans

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage increase transit network coverage
- Existing transit mode share
- Project location: urban center, urban, or suburban

[71] Transit vehicles may also result in increases in emissions that are associated with electricity production or fuel use. The Project Applicant should consider these potential additional emissions when estimating mitigation for these measures.

The following are optional inputs. Average (default) values are included in the calculations but can be updated to project specificity if desired. Please see Appendix C for calculation detail:

- Average vehicle occupancy

Mitigation Method:

% VMT Reduction = Coverage * B * Mode * D

Where

Coverage = % increase in transit network coverage
B = elasticity of transit ridership with respect to service coverage (see Table below)
Mode = existing transit mode share
D = adjustments from transit ridership increase to VMT (0.67, from Appendix C)

B:

Project setting	Elasticity
Suburban	1.01
Urban	0.72
Urban Center	0.65
Source: TCRP 95, Chapter 10	

Mode: Provide existing transit mode share for project or utilize the following averages

Project setting	Transit mode share
Suburban	1.3%
Urban	4%
Urban Center	17%
Source: NHTS, 2001http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_StwTravelSurveyWkdayRpt.pdf (Urban – MTC, SACOG. Suburban – SCAG, SANDAG, Fresno County.) Urban Center from San Francisco County Transportation Authority Countywide Transportation Plan, 2000.	

Assumptions:

Data based upon the following references:

[1] Transit Cooperative Research Program. TCRP Report 95 Traveler Response to System Changes – Chapter 10: Bus Routing and Coverage. 2004. (p. 10-8 to 10-10)

Emission Reduction Ranges and Variables:

Pollut0ant	Category Emissions Reductions[72]
CO_2e	0.1 – 8.2% of running
PM	0.1 – 8.2% of running
CO	0.1 – 8.2% of running
NOx	0.1 – 8.2% of running
SO_2	0.1 – 8.2% of running
ROG	0.06 – 4.9% of total

Discussion:

In general, transit operational strategies alone are not enough for a large modal shift [2], as evidenced by the low range in VMT reductions. Through case study analysis, the TCRP report [2] observed that strategies that focused solely on improving level of service or quality of transit were unsuccessful at achieving a significant shift. Strategies that reduce the attractiveness of vehicle travel should be implemented in combination to attract a larger shift in transit ridership. The three following factors directly impact the attractiveness of vehicle travel: urban expressway capacity, urban core density, and downtown parking availability.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (10% expansion, suburban) = 10% * 1.01 * 1.3% * .67 = 0.1%
- High Range % VMT Reduction (100% expansion, urban) = 100% * 0.72 * 17% * .67 = 8.2%

The low and high ranges are estimates and may vary based on the characteristics of the project.

[72] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

Preferred Literature:

- 0.65 = elasticity of transit ridership with respect to service coverage/expansion (in radial routes to central business districts)
- 0.72 = elasticity of transit ridership with respect to service coverage/expansion (in central city routes)
- 1.01 = elasticity of transit ridership with respect to service coverage/expansion (in suburban routes)

TCRP 95 Chapter 10 [1] documents the results of system-wide service expansions in San Diego. The least sensitivity to service expansion came from central business districts while the largest impacts came from suburban routes. Suburban locations, with traditionally low transit service, tend to have greater ridership increases compared to urban locations which already have established transit systems. In general, there is greater opportunity in suburban locations.

Alternative Literature:

- -0.06 = elasticity of VMT with respect to transit revenue miles

Growing Cooler [3] modeled the impact of various urban variables (including transit revenue miles and transit passenger miles) on VMT, using data from 84 urban areas around the U.S.

Alternative Literature References:

[2] Transit Cooperative Research Program. TCRP 27 – Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It (p.47-48). 1997. [cited in discussion section above]

[3] Ewing, et al, 2008. Growing Cooler – The Evidence on Urban Development and Climate Change. Urban Land Institute.

3.5.4 Increase Transit Service Frequency/Speed

Range of Effectiveness: 0.02 – 2.5% vehicle miles traveled (VMT) reduction and therefore 0.02 – 2.5% reduction in GHG emissions[73]

Measure Description:

This project will reduce transit-passenger travel time through more reduced headways and increased speed and reliability. This makes transit service more attractive and may result in a mode shift from auto to transit which reduces VMT.

Measure Applicability:

- Urban and suburban context
- May be applicable in a rural context but no literature documentation available (effectiveness will be case specific and should be based on specific assessment of levels of services and origins/destinations served)
- Appropriate for specific or general plans

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage reduction in headways (increase in frequency)
- Level of implementation
- Project setting: urban center, urban, suburban
- Existing transit mode share

[73] Transit vehicles may also result in increases in emissions that are associated with electricity production or fuel use. The Project Applicant should consider these potential additional emissions when estimating mitigation for these measures.

The following are optional inputs. Average (default) values are included in the calculations but can be updated to project-specific values if desired. Please see Appendix C for calculation detail:

- Average vehicle occupancy

Mitigation Method:

% VMT Reduction = Headway * B * C * Mode * E

Where

Headway = % reduction in headways
B = elasticity of transit ridership with respect to increased frequency of service (from [1])
C = adjustment for level of implementation
Mode = existing transit mode share
E = adjustments from transit ridership increase to VMT

Detail:

- Headway: reasonable ranges from 15 – 80%
- B:

Setting	Elasticity
Urban	0.32
Suburban	0.36
Source: TCRP Report 95 Chapter 9	

- C:

Level of implementation = number of lines improved / total number of lines serving project	Adjustment
<50%	50%
>=50%	85%
Fehr & Peers, 2010.	

- Mode: Provide existing transit mode share for project or utilize the following averages

Project setting	Transit mode share
Suburban	1.3%
Urban	4%
Urban Center	17%
Source: NHTS, 2001http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_StwTravelSurveyWkdayRpt.pdf (Urban – MTC, SACOG. Suburban – SCAG, SANDAG, Fresno County.)	

Urban Center from San Francisco County Transportation Authority Countywide Transportation Plan, 2000.

- E: 0.67 (see Appendix C for detail)

Assumptions:

Data based upon the following references:

[1] Transit Cooperative Research Program. TCRP Report 95 Traveler Response to System Changes – Chapter 9: Transit Scheduling and Frequency (p. 9-14)

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[74]
CO_2e	0.02 – 2.5% % of running
PM	0.02 – 2.5% % of running
CO	0.02 – 2.5% % of running
NOx	0.02 – 2.5% % of running
SO_2	0.02 – 2.5% % of running
ROG	0.01 – 1.5% % of total

Discussion:

Reasonable ranges for reductions were calculated assuming existing 30-minute headways reduced to 25 minutes and 5 minutes to establish the estimated low and high reductions, respectively.

The level of implementation adjustment is used to take into account increases in transit ridership due to shifts from other lines. If increases in frequency are only applied to a percentage of the lines serving the project, then we conservatively estimate that 50% of the transit ridership increase is a shift from the existing lines. If frequency increases are applied to a majority of the lines serving the project, we conservatively assume at least some of the transit ridership (15%) comes from existing riders.

In general, transit operational strategies alone are not enough for a large modal shift [2], as evidenced by the low range in VMT reductions. Through case study analysis, the TCRP report [2] observed that strategies that focused solely on improving level of service or quality of transit were unsuccessful at achieving a significant shift. Strategies that reduce the attractiveness of vehicle travel should be implemented in combination to attract a larger shift in transit ridership. The three following factors directly impact the

[74] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

attractiveness of vehicle travel: urban expressway capacity, urban core density, and downtown parking availability.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (15% reduction in headways, suburban, <50% implementation) = 15% * 0.36 * 50% * 1.3% *0.67 = 0.02%
- High Range % VMT Reduction (80% reduction in headways, urban, >50% implementation) = 80% * 0.32 * 85% * 17% * 0.67 = 2.5%

Preferred Literature:

- 0.32 = elasticity of transit ridership with respect to transit service (urban)
- 0.36 – 0.38 = elasticity of transit ridership with respect to transit service (suburban)

TCRP 95 Chapter 9 [1] documents the results of frequency changes in Dallas. Increases in frequency are more sensitive in a suburban environment. Suburban locations, with traditionally low transit service, tend to have greater ridership increases compared to urban locations which already have established transit systems. In general, there is greater opportunity in suburban locations

Alternative Literature:

- 0.5 = elasticity of transit ridership with respect to increased frequency of service
- 1.5 to 2.3% increase in annual transit trips due to increased frequency of service
- 0.4-0.5 = elasticity of ridership with respect to increased operational speed
- 4% - 15% increase in annual transit trips due to increased operational speed
- 0.03-0.09% annual GHG reduction (for bus service expansion, increased frequency, and increased operational speed)

For increased frequency of service strategy, *Moving Cooler* [3] looked at three levels of service increases, 3%, 3.5% and 4.67% increases in service, resulting in a 1.5 – 2.3% increase in annual transit trips. For increased speed and reliability, Moving Cooler looked at three levels of speed/reliability increases. Improving travel speed by 10% assumed implementing signal prioritization, limited stop service, etc. over 5 years. Improving travel speed by 15% assumed all above strategies plus signal synchronization and intersection reconfiguration over 5 years. Improving travel speed by 30% assumed all above strategies and an improved reliability by 40%, integrated fare system, and implementation of BRT where appropriate. *Moving Cooler* calculates estimated 0.04-0.14% annual GHG reductions in combination with bus service expansion strategy.

Alternative Literature References:

[2] Transit Cooperative Research Program. TCRP 27 – Building Transit Ridership: An Exploration of Transit's Market Share and the Public Policies That Influence It (p.47-48). 1997. [cited in discussion section]

[3] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p B-32, B-33, Table D.3) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf

3.5.5 Provide Bike Parking Near Transit

Range of Effectiveness: Grouped strategy. [See TST-3 and TST-4]

Measure Description:

Provide short-term and long-term bicycle parking near rail stations, transit stops, and freeway access points. The benefits of Station Bike Parking have no quantified impacts as a standalone strategy and should be grouped with Transit Network Expansion (TST-3) and Increase Transit Service Frequency and Speed (TST-4) to encourage multi-modal use in the area and provide ease of access to nearby transit for bicyclists.

Measure Applicability:

- Urban, suburban context
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

No literature was identified that specifically looks at the quantitative impact of including transit station bike parking.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.5.6 Provide Local Shuttles

Range of Effectiveness: Grouped strategy. [See TST-4 and TST-5]

Measure Description:

The project will provide local shuttle service through coordination with the local transit operator or private contractor. The local shuttles will provide service to transit hubs, commercial centers, and residential areas. The benefits of Local Shuttles alone have not been quantified and should be grouped with Transit Network Expansion (TST-4) and Transit Service Frequency and Speed (TST-5) to solve the "first mile/last mile" problem. In addition, many of the CommuteTrip Reduction Programs (Section 2.4, TRP 1-13) also included local shuttles.

Measure Applicability:

- Urban, suburban context
- Appropriate for large residential, retail, office, mixed use, and industrial projects

Alternative Literature:

No literature was identified to support the effectiveness of this strategy alone.

Alternative Literature References:

None

Other Literature Reviewed:

None

3.6 Road Pricing/Management

3.6.1 Implement Area or Cordon Pricing

Range of Effectiveness: 7.9 – 22.0% vehicle miles traveled (VMT) reduction and therefore 7.9 – 22.0% reduction in GHG emissions.

Measure Description:

This project will implement a cordon pricing scheme. The pricing scheme will set a cordon (boundary) around a specified area to charge a toll to enter the area by vehicle. The cordon location is usually the boundary of a central business district (CBD) or urban center, but could also apply to substantial development projects with limited points of access, such as the proposed Treasure Island development in San Francisco. The cordon toll may be static/constant, applied only during peak periods, or be variable, with higher prices during congested peak periods. The toll price can be based on a fixed schedule or be dynamic, responding to real-time congestion levels. It is critical to have an existing, high quality transit infrastructure for the implementation of this strategy to reach a significant level of effectiveness. The pricing signals will only cause mode shifts if alternative modes of travel are available and reliable.

Measure Applicability:

- Central business district or urban center only

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Percentage increase in pricing for passenger vehicles to cross cordon
- Peak period variable price or static all-day pricing (London scheme)

The following are optional inputs. Average (default) values are included in the calculations but can be updated to project-specific values if desired. Please see Appendix C for calculation detail:

- % (due to pricing) route shift, time-of-day shift, HOV shift, trip reduction, shift to transit/walk/bike

Mitigation Method:

% VMT Reduction = Cordon$ * B * C

Where

Cordon$	= % increase in pricing for passenger vehicles to cross cordon
B	= Elasticity of VMT with respect to price (from [1])
C	= Adjustment for % of VMT impacted by congestion pricing and mode shifts

Detail:

- Cordon$: reasonable range of 100 – 500% (See Appendix C for detail))
- B: 0.45 [1]
- C:

Cordon pricing scheme	Adjustment
Peak-period variable pricing	8.8%
Static all-day pricing	21%
Source: See Appendix C for detail	

Assumptions:

Data based upon the following references:

[1] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. (p. B-13, B-14) http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

- Referencing: VTPI, *Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior.* July 2008. www.vtpi.org

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[75]
CO_2e	7.9 - 22.0% of running
PM	7.9 - 22.0% of running
CO	7.9 - 22.0% of running
NOx	7.9 - 22.0% of running
SO_2	7.9 - 22.0% of running
ROG	4.7 – 13.2% of total

Discussion:

The amount of pricing will vary on a case-by-case basis. The 100 – 500% increase is an estimated range of increases and should be adjusted to reflect the specificities of the pricing scheme implemented. Take care in calculating the percentage increase in price if baseline is $0.00. An upper limit of 500% may be a good check point. If baseline is zero, the Project Applicant may want to conduct calculations with a low baseline such as $1.00.

These calculations assume that the project is within the area cordon, essentially assuming that 100% of project trips will be affected. See Appendix C to make appropriate adjustments.

Example:

Sample calculations are provided below:

- Low Range % VMT Reduction (100% increase in price, peak period pricing) = 100% * 0.45 * 8.8% = 4.0%
- High Range % VMT Reduction (500% increase in price, all-day pricing) = 500% * 0.45 * 21% = 47.3% = 22% (established maximum based on literature)

Preferred Literature:

- -0.45 VMT elasticity with regard to pricing
- 0.04-0.08% greenhouse gas (GHG) reduction

Moving Cooler [1] assumes an average of 3% of regional VMT would cross the CBD cordon. A VMT reduction of 20% was estimated to require an average of 65 cents/mile applied to all congested VMT in the CBD, major employment, and retail centers. The

[75] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

range in GHG reductions is attributed to the range of implementation and start date. *Moving Cooler* reports an elasticity range from -0.15 to -0.47 from VTPI. *Moving Cooler* utilizes a stronger elasticity (0.45) to represent greater impact cordon pricing will have on users compared to other pricing strategies.

Alternative Literature:

- 6.5-14.0% reduction in carbon emissions
- 16-22% reduction in vehicles
- 6-9% increase in transit use

The Center for Clean Air Policy (CCAP) [2] cites two case studies in Europe, one in London and one in Stockholm, which show vehicle reductions of 16% and 22%, respectively. London's fee reduced CO_2 by 6.5%. Stockholm's program reduced injuries by 10%, increased transit use by 6-9%, and reduced carbon emissions by 14% in the central city within months of implementation.

Alternative Literature References:

[2] Center for Clean Air Policy (CCAP), *Short-term Efficiency Measures.* (p. 1) http://www.ccap.org/docs/resources/715/Short-Term%20Travel%20Efficiency%20Measures%20cut%20GHGs%209%2009%20final.pdf

CCAP cites Transport for London. *Central London Congestion Charging: Impacts Monitoring*, *Sixth Annual Report*. July 2008 http://www.tfl.gov.uk/assets/downloads/sixth-annual-impacts-monitoring-report-2008-07.pdf (p. 6) and Leslie Abboud and Jenny Clevstrom, "Stockholm's Syndrome," August 29, 2006, *Wall Street Journal.*http://transportation.northwestern.edu/mahmassani/Media/WSJ_8.06.pdf (p. 2)

Other Literature Reviewed:

None

3.6.2 Improve Traffic Flow

Range of Effectiveness: 0 - 45% reduction in GHG emissions

Measure Description:

The project will implement improvements to smooth traffic flow, reduce idling, eliminate bottlenecks, and management speed. Strategies may include signalization improvements to reduce delay, incident management to increase response time to breakdowns and collisions, Intelligent Transportation Systems (ITS) to provide real-time information regarding road conditions and directions, and speed management to reduce high free-flow speeds.

This measure does not take credit for any reduction in GHG emissions associated with changes to non-project traffic VMT. If Project Applicant wants to take credit for this benefit, the non-project traffic VMT would also need to be covered in the baseline conditions.

Measure Applicability:

- Urban, suburban, and rural context

Baseline Method:

See introduction to transportation section for a discussion of how to estimate trip rates and VMT. The CO_2 emissions are calculated from VMT as follows:

$$CO_2 = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled

$EF_{running}$ = emission factor for running emissions

Inputs:

The following information needs to be provided by the Project Applicant:

- Average base-year travel speed (miles per hour (mph)) on implemented roads (congested[76] condition)

[76] A roadway is considered "congested" if operating at Level of Service (LOS) E or F

- Future travel speed (mph) on implemented roads for both a) congested and b) free-flow[77] condition
- Total vehicle miles traveled (VMT) on implemented roadways
- Total project-generated VMT

Mitigation Method:

$$\% \ CO_2 \text{ Emissions Reduction} = 1 - \frac{\text{Project GHG Emission}_{\text{post strategy}}}{\text{Project GHG emission}_{\text{baseline}}}$$

Where

Project GHG emission$_{\text{post strategy}}$ = $EF_{running}$ after strategy implementation * project VMT
Project GHG emission$_{\text{baseline}}$ = $EF_{running}$ before strategy implementation * project VMT
$EF_{running}$ = emission factor for running emissions [from table presented under "Detail" below]

Detail:

mph	Grams of CO_2 / mile	
	congested	Free-flow
5	1,110	823
10	715	512
15	524	368
20	424	297
25	371	262
30	343	247
35	330	244
40	324	249
45	323	259
50	325	273
55	328	289
60	332	306
65	339	325
70	353	347
75	377	375
80	420	416
85	497	478
Source: Barth, 2008, Fehr & Peers [1]		

[77] A roadway is considered "free flow" if operating at LOS D or better

By only including the project VMT portion, the reduction is typically on scale with the percentage of cost for traffic improvements and full reduction calculated for project VMT should be used. However, if the project cost is a greater share than their contribution to the VMT on the road, than the project and non-project VMT should be calculated and the percent reduction should be multiplied by the percent cost allocation. The GHG emission reductions associated with non-project VMT (if applicable) would be calculated as follows:

Metric Tonnes GHG reduced due to improving non-Project traffic flow = % Cost Allocation * Non-Project VMT * ($EF_{congested}$ – $EF_{freeflow}$) / (1,000,000 gram/MT)

Where:

Non-Project VMT that the Project's cost share impacts = portion of non-project VMT

$EF_{congested}$ = emissions for congested road in g/VMT

$EF_{freeflow}$ = emissions for freeflow road in g/VMT

Assumptions:

Data based upon the following references:

[1] Barth and Boriboonsomsin, "Real World CO_2 Impacts of Traffic Congestion", *Transportation Research Record, Journal of the Transportation Research Board,* No. 2058, Transportation Research Board, National Academy of Science, 2008.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions[78]
CO_2e	0 - 45% of running
PM	0 - 45% of running
CO	0 - 45% of running

[78] The percentage reduction reflects emission reductions from running emissions. The actual value will be less than this when starting and evaporative emissions are factored into the analysis. ROG emissions have been adjusted to reflect a ratio of 40% evaporative and 60% exhaust emissions based on a statewide EMFAC run of all vehicles.

NOx	0 - 45% of running
SO_2	0 - 45% of running
ROG	0 - 27% of total

Discussion:

Care must be taken when estimating effectiveness since significantly improving traffic flow essentially lowers the cost and delay involved in travel, which under certain circumstances may induce additional VMT. [See Appendix C for a discussion on induced travel.]

The range of effectiveness presented above is a very rough estimate as emissions reductions will be highly dependent on the level of implementation and degree of congestion on the existing roadways. In addition, the low range of effectiveness was stated at 0% to highlight the potential of induced travel negating benefits achieved from this strategy.

Example:

Sample calculations are provided below:

- Signal timing coordination implementation:
  - Existing congested speeds of 25 mph
  - Conditions post-implementation: would improve to 25 mph free flow speed
  - Proposed project daily traffic generation is 200,000 VMT
  - Project CO_2 $Emissions_{baseline}$ = (371 g CO_2/mile) * (200,000 VMT daily) * (1 MT / 1 x 10^6 g) = 74 MT of CO_2 daily
  - Project CO_2 $Emissions_{post\ strategy}$ = (262 g CO_2/mile) * (200,000 VMT daily) * (1 MT / 1 x 10^6 g) = 52.4 MT of CO_2 daily
  - Percent CO_2emissions reduction = 1- (52.4 MT/ 74 MT) = 29%
- Speed management technique:
  - Existing free-flow speeds of 75 mph
  - Conditions post-implementation: reduce to 55 mph free flow speed
  - Proposed project daily traffic generation is 200,000 VMT
  - Project CO_2 $Emissions_{baseline}$ = (375 g CO_2/mile) * (200,000 VMT daily) * (1 MT / 1 x 10^6 g) = 75 MT of CO_2 daily
  - Project CO_2 $Emissions_{post\ strategy}$ = (289 g CO_2/mile) * (200,000 VMT daily) * (1 MT / 1 x 10^6 g) = 58 MT of CO_2 daily
  - Percent CO_2emissions reduction= 1 – (58 tons/ 75 tons) = 23%

Preferred Literature:

- 7 – 12% reduction in CO_2 emissions

This study [1] examined traffic conditions in Southern California using energy and emissions modeling and calculated the impacts of 1) congestion mitigation strategies to smooth traffic flow, 2) speed management techniques to reduce high free-flow speeds, and 3) suppression techniques to eliminate acceleration/deceleration associated with stop-and-go traffic. Using typical conditions on Southern California freeways, the strategies could reduce emissions by 7 to 12 percent.

The table (in the mitigation method section) was calculated using the CO_2 emissions equation from the report:

$$\ln(y) = b_0 + b_1 * x + b_2 * x^2 + b_3 * x^3 + b_4 * x^4$$

where

y = CO_2 emission in grams / mile
x = average trip speed in miles per hour (mph)

The coefficients for b_i were based off of Table 1 of the report, which then provides an equation for both congested conditions (real-world) and free-flow (steady-state) conditions.

Alternative Literature:

- 4 - 13% reduction in fuel consumption

The FHWA study [2] looks at various case studies of traffic flow improvements. In Los Angeles, a new traffic control signal system was estimated to reduce signal delays by 44%, vehicle stops by 41%, and fuel consumption by 13%. In Virginia, a study of retiming signal systems estimated reductions of stops by 25%, travel time by 10%, and fuel consumption by 4%. In California, optimization of 3,172 traffic signals through 1988 (through California's Fuel Efficient Traffic Signal Management program) documented an average reduction in vehicle stops of 16% and in fuel use of 8.6%. The 4-13% reduction in fuel consumption applies only to that vehicular travel directly benefited by the traffic flow improvements, specifically the VMT within the corridor in which the ITS is implemented and only during the times of day that would otherwise be congested without ITS. For example, signal coordination along an arterial normally congested in peak commute hours would produce a 4-13% reduction in fuel consumption only for the VMT occurring along that arterial during weekday commute hours.

Alternate:

- Up to 0.02% *increase* in greenhouse gas (GHG) emissions

Moving Cooler [3] estimates that bottleneck relief will result in an increase in GHG emissions during the 40-year period, 2010 to 2050. In the short term, however, improved roadway conditions may improve congestion and delay, and thus reduce fuel consumption. VMT and GHG emissions are projected to increase after 2030 as induced demand begins to consume the roadway capacity. The study estimates a maximum increase of 0.02% in GHG emissions.

Alternative Literature References:

[2] FHWA, *Strategies to Reduce Greenhouse Gas Emissions from Transportation Sources*. http://www.fhwa.dot.gov/environment/glob_c5.pdf.

[3] Cambridge Systematics. *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.* Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendix%20B_Effectiveness_102209.pdf

Other Literature Reviewed:

None

3.6.3 Required Project Contributions to Transportation Infrastructure Improvement Projects

Range of Effectiveness: Grouped strategy. [See RPT-2 and TST-1 through 7]

Measure Description:

The project should contribute to traffic-flow improvements or other multi-modal infrastructure projects that reduce emissions and are not considered as substantially growth inducing. The local transportation agency should be consulted for specific needs.

Larger projects may be required to contribute a proportionate share to the development and/or continuation of a regional transit system. Contributions may consist of dedicated right-of-way, capital improvements, easements, etc. The local transportation agency should be consulted for specific needs.

Refer to Traffic Flow Improvements (RPT-2) or the Transit System Improvements (TST-1 through 7) strategies for a range of effectiveness in these categories. The benefits of Required Contributions may only be quantified when grouped with related improvements.

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

Although no literature discusses project contributions as a standalone measure, this strategy is a supporting strategy for most operations and infrastructure projects listed in this report.

Other Literature Reviewed:

None

3.6.4 Install Park-and-Ride Lots

Range of Effectiveness: Grouped strategy. [See RPT-1, TRT-11, TRT-3, and TST-1 through 6]

Measure Description:

This project will install park-and-ride lots near transit stops and High Occupancy Vehicle (HOV) lanes. Park-and-ride lots also facilitate car- and vanpooling. Refer to Implement Area or Cordon Pricing (RPT-1), Employer-Sponsored Vanpool/Shuttle (TRT-11), Ride Share Program (TRT-3), or the Transit System Improvement strategies (TST-1 through 6) for ranges of effectiveness within these categories. The benefits of Park-and-Ride Lots are minimal as a stand-alone strategy and should be grouped with any or all of the above listed strategies to encourage carpooling, vanpooling, ride-sharing, and transit usage.

Measure Applicability:

- Suburban and rural context
- Appropriate for residential, retail, office, mixed use, and industrial projects

Alternative Literature:

Alternate:

- 0.1 – 0.5% vehicle miles traveled (VMT) reduction

A 2005 FHWA [1] study found that regional VMT in metropolitan areas may be reduced between 0.1 to 0.5% (citing Apogee Research, Inc., 1994). The reduction potential of this strategy may be limited because it reduces the trip length but not vehicle trips.

Alternate:

- 0.50% VMT reduction per day

Washington State Department of Transportation (WSDOT) [2] notes the above number applies to countywide interstates and arterials.

Alternative Literature References:

[1] FHWA. Transportation and Global Climate Change: A Review and Analysis of the Literature – Chapter 5: Strategies to Reduce Greenhouse Gas Emissions from Transportation Sources. http://www.fhwa.dot.gov/environment/glob_c5.pdf

[2] Washington State Department of Transportation. *Cost Effectiveness of Park-and-Ride Lots in the Puget Sound Area.* http://www.wsdot.wa.gov/research/reports/fullreports/094.1.pdf

Other Literature Reviewed:

None

3.7 Vehicles

3.7.1 Electrify Loading Docks and/or Require Idling-Reduction Systems

Range of Effectiveness: 26-71% reduction in TRU idling GHG emissions

Measure Description:

Heavy-duty trucks transporting produce or other refrigerated goods will idle at truck loading docks and during layovers or rest periods so that the truck engine can continue to power the cab cooling elements. Idling requires fuel use and results in GHG emissions.

The Project Applicant should implement an enforcement and education program that will ensure compliance with this measure. This includes posting signs regarding idling restrictions as well as recording engine meter times upon entering and exiting the facility.

Measure Applicability:

- Truck refrigeration units (TRU)

Inputs:

The following information needs to be provided by the Project Applicant:

- Electricity provider for the Project
- Horsepower of TRU
- Hours of operation

Baseline Method:

$$\text{GHG emission} = \frac{CO_2\ \text{Exhaust}}{\text{Activity} \times \text{AvgHP} \times LF} \times Hp \times Hr \times C \times LF$$

Where:

GHG emission = MT CO_2e

CO_2 Exhaust = Statewide daily CO_2 emission from TRU for the relevant horsepower tier (tons/day). Obtained from OFFROAD2007.

Activity = Statewide daily average TRU operating hours for the relevant horsepower tier (hours/day). Obtained from OFFROAD2007.

AvgHP = Average TRU horsepower for the relevant horsepower tier (HP). Obtained from OFFROAD2007.

Hp = Horsepower of TRU.

Hr = Hours of operation.

C = Unit conversion factor

LF = Load factor of TRU for the relevant horsepower tier (dimensionless). Obtained from OFFROAD 2007.

Note that this method assumes the load factor of the TRU is same as the default in OFFROAD2007.

Mitigation Method:

Electrify loading docks

TRUs will be plugged into electric loading dock instead of left idling. The indirect GHG emission from electricity generation is:

$$\text{GHG emission} = Utility \times Hp \times LF \times Hr \times C$$

Where:

GHG emissions = MT CO_2e
Utility = Carbon intensity of Local Utility (CO_2e/kWh)
Hp = Horsepower of TRU.
LF = Load factor of TRU for the relevant horsepower tier (dimensionless). Obtained from OFFROAD2007.
Hr = Hours of operation.
C = Unit conversion factor

GHG Reduction %[79] $= 1 - \dfrac{Utility \times C}{EF \times 10^{-6}}$

Idling Reduction

Emissions from reduced TRU idling periods are calculated using the same methodology for the baseline scenario, but with the shorter hours of operation.

$$\text{GHG Reduction \%} = 1 - \frac{time_{mitigated}}{time_{baseline}}$$

Electrify loading docks

Power Utility	TRU Horsepower (HP)	Idling Emission Reductions[80]
LADW&P	< 15	26.3%
	< 25	26.3%
	< 50	35.8%

[79] This assumes energy from engine losses are the same.
[80] This reduction percentage applies to all GHG and criteria pollutant idling emissions.

PG&E	< 15	72.9%
	< 25	72.9%
	< 50	76.3%
SCE	< 15	61.8%
	< 25	61.8%
	< 50	66.7%
SDGE	< 15	53.5%
	< 25	53.5%
	< 50	59.5%
SMUD	< 15	67.0%
	< 25	67.0%
	< 50	71.2%

Idling Reduction

Emission reduction from shorter idling period is same as the percentage reduction in idling time.

Discussion:

The output from OFFROAD2007 shows the same emissions within each horsepower tier regardless of the year modeled. Therefore, the emission reduction is dependent on the location of the Project and horsepower of the TRU only.

Assumptions:

Data based upon the following references:

- California Air Resources Board. Off-road Emissions Inventory. OFFROAD2007. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm
- California Climate Action Registry Reporting Online Tool. 2006 PUP Reports. Available online at: https://www.climateregistry.org/CARROT/public/reports.aspx

Preferred Literature:

The electrification of truck loading docks can allow properly equipped trucks to take advantage of external power and completely eliminate the need for idling. Trucks would need to be equipped with internal wiring, inverter, system, and a heating, ventilation, and air conditioning (HVAC) system. Under this mitigation measure, the direct emissions from fuel combustion are completely displaced by indirect emissions from the CO_2 generated during electricity production. The amount of electricity required depends on the type of truck and refrigeration elements; this data could be determined from manufacturer specifications. The total kilowatt-hours required should be multiplied by the carbon-intensity factor of the local utility provider in order to calculate the amount of indirect CO_2 emissions. To take credit for this mitigation measure, the Project Applicant would need to provide detailed evidence supporting a calculation of the emissions reductions.

Alternative Literature:

None

Other Literature Reviewed:

1. USEPA. 2002. Green Transport Partnership, A Glance at Clean Freight Strategies: Idle Reduction. Available online at: http://nepis.epa.gov/Adobe/PDF/P1000S9K.PDF
2. ATRI. 2009. Research Results: Demonstration of Integrated Mobile Idle Reduction Solutions. Available online at: http://www.atri-online.org/research/results/ATRI1pagesummaryMIRTDemo.pdf

None

3.7.2 Utilize Alternative Fueled Vehicles

Range of Effectiveness: Reduction in GHG emissions varies depending on vehicle type, year, and associated fuel economy.

Measure Description:

When construction equipment is powered by alternative fuels such as biodiesel (B20), liquefied natural gas (LNG), or compressed natural gas (CNG) rather than conventional petroleum diesel or gasoline, GHG emissions from fuel combustion may be reduced.

Measure Applicability:

- Vehicles

Inputs:

The following information needs to be provided by the Project Applicant:

- Vehicle category
- Traveling speed (mph)
- Number of trips and trip length, or Vehicle Miles Traveled (VMT)
- Fuel economy (mpg) or Fuel consumption

Baseline Method:

$$\text{Baseline } CO_2 \text{ Emission} = EF \times \frac{1}{FE} \times VMT \times C$$

Where:

Baseline CO_2 Emission	=	MT of CO_2
EF	=	CO_2 emission factor, from CCAR General Reporting Protocol (g/gallon)
VMT	=	Vehicle miles traveled (VMT) = T x L
FE	=	Fuel economy (mpg)
C	=	Unit conversion factor

$$\text{Baseline } N_2O/CH_4 \text{ Emission} = EF \times VMT \times C$$

Where:

Baseline N_2O/CH_4 Emission	=	MT of N_2O or CH_4
EF	=	N_2O or CH_4 emission factor, from CCAR General Reporting Protocol (g/mile)
VMT	=	Vehicle miles traveled (VMT) = T x L
T	=	Number of one-way trips
L	=	One-way trip length
FC	=	Fuel consumption (gallon) = VMT/FE

FE = Fuel economy (mpg)
C = Unit conversion factor

The total baseline GHG emission is the sum of the emissions of CO_2, N_2O and CH_4, adjusted by their global warming potentials (GWP):

Baseline GHG Emission

= Baseline CO_2 Emission + Baseline N_2O Emission × 310 +Baseline CH_4 Emission × 21

Where:

Baseline GHG Emission = MT of CO_2e
310 = GWP of N_2O
21 = GWP of CH_4

Mitigation Method:

Mitigated emissions from using alternative fuel is calculated using the same methodology before, but using emission factors for the alternative fuel, and fuel consumption calculated as follows:

$$GHG\ emissions = \frac{1}{FE} \times ER \times VMT \times EF_{CO2} + VMT \times EF_{N20} + VMT \times EF_{CH4}$$

Where:

ER = Energy ratio from US Department of Energy (see table below)
EF = Emission Factor for pollutant
VMT = Vehicle miles traveled (VMT)
FE = Fuel economy (mpg)

Fuel	Energy Ratio: Amount of fuel needed to provide same energy as			
	1 gallon of Gasoline		1 gallon of Diesel	
Gasoline	1	gal	1.13	gal
#2 Diesel	0.88	gal	1	gal
B20	0.92	gal	1.01	gal
CNG	126.67	ft^3	143.14	ft^3
LNG	1.56	gal	1.77	gal
LPC	1.37	gal	1.55	gal

Emission reductions can be calculated as:

$$\text{Reduction} = 1 - \frac{\text{Mitigated Emission}}{\text{Running Emission}}$$

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Range Not Quantified[81]
PM	Range Not Quantified
CO	Range Not Quantified
NOx	Range Not Quantified
SO_2	Range Not Quantified
ROG	Range Not Quantified

Discussion:

Using the methodology described above, only the running emission is considered. A hypothetical scenario for a gasoline fueled light duty automobile in 2015 is illustrated below. The CO_2 emission factor from motor gasoline in CCAR 2009 is 8.81 kg/gallon. Assuming the automobile makes two trips of 60 mile each per day, and using the current passenger car fuel economy of 27.5 mpg under the CAFE standards, then the annual baseline CO_2 emission from the automobile is:

$$8.81 \times \frac{2 \times 60 \times 365}{27.5} \times 10^{-3} = 14.0 \text{ MT/year}$$

Where 10^{-3} is the conversion factor from kilograms to MT.

Using the most recent N_2O emission factor of 0.0079 g/mile in CCAR 2009 for gasoline passenger cars, the annual baseline N_2O emission from the automobile is:

$$0.0079 \times 2 \times 365 \times 60 \times 10^{-6} = 0.000346 \text{ MT/year}$$

[81] The emissions reductions varies and depends on vehicle type, year, and the associated fuel economy. The methodology above describes how to calculate the expected GHG emissions reduction assuming the required input parameters are known.

Similarly, using the same formula with the most recent CH_4 emission factor of 0.0147 g/mile in CCAR 2009 for gasoline passenger cars, the annual baseline CH_4 emission from the automobile is calculated to be 0.000644 MT/year.

Thus, the total baseline GHG emission for the automobile is:

$$14.0 + 0.000346 \times 310 + 0.000644 \times 21 = 14.1 \text{ MT/year}$$

If compressed natural gas (CNG) is used as alternative fuel, the CNG consumption for the same VMT is:

$$\frac{2 \times 60 \times 365}{27.5} \times 126.67 = 201{,}751 \text{ ft}^3$$

Using the same formula as for the baseline scenario but with emission factors of CNG and the CNG consumption, the mitigated GHG emission can be calculated as shown in the table below

Pollutant	Emission (MT/yr)
CO_2	11.0
N_2O	0.0022
CH_4	0.0323
CO_2e	12.4

Therefore, the emission reduction is:

$$1 - \frac{12.4}{14.0} = 11.4\%$$

Notice that in the baseline scenario, N_2O and CH_4 only make up <1% of the total GHG emissions, but actually increase for the mitigated scenario and contribute to >10% of total GHG emissions.

Assumptions:

Data based upon the following references:

- California Climate Action Registry (CCAR). 2009. General Reporting Protocol. Version 3.1. Available online at: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html

- US Department of Energy. 2010. Alternative and Advanced Fuels – Fuel Properties. Available online at: http://www.afdc.energy.gov/afdc/fuels/properties.html

Preferred Literature:

The amount of emissions avoided from using alternative fuel vehicles can be calculated using emission factors from the California Climate Action Registry (CCAR) General Reporting Protocol [1]. Multiplying this factor by the fuel consumption or vehicle miles traveled (VMT) gives the direct emissions of CO_2 and N_2O /CH_4, respectively. Fuel consumption and VMT can be calculated interchangeably with the fuel economy (mpg). The total GHG emission is the sum of the emissions from the three chemicals multiplied by their respective global warming potential (GWP).

Assuming the same VMT, the amount of alternative fuel required to run the same vehicle fleet can be calculated by multiplying gasoline/diesel fuel consumption by the equivalent-energy ratio obtained from the US Department of Energy [2]. Using the alternative fuel consumption and the emission factors for the alternative fuel from CCAR, the mitigated GHG emissions can be calculated. The GHG emissions reduction associated with this mitigation measure is therefore the difference in emissions from these two scenarios.

Alternative Literature:

None

Notes:

[1] California Climate Action Registry (CCAR). 2009. General Reporting Protocol. Version 3.1. Available online at: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html
[2] US Department of Energy. 2010. Alternative and Advanced Fuels – Fuel Properties. Available online at: http://www.afdc.energy.gov/afdc/fuels/properties.html

Other Literature Reviewed:

None

3.7.3 Utilize Electric or Hybrid Vehicles

Range of Effectiveness: 0.4 - 20.3% reduction in GHG emissions

Measure Description:

When vehicles are powered by grid electricity rather than fossil fuel, direct GHG emissions from fuel combustion are replaced with indirect GHG emissions associated with the electricity used to power the vehicles. When vehicles are powered by hybrid-electric drives, GHG emissions from fuel combustion are reduced.

Measure Applicability:

- Vehicles

Inputs:

The following information needs to be provided by the Project Applicant:

- Vehicle category
- Traveling speed (mph)
- Number of trips and trip length, or Vehicle Miles Traveled (VMT)
- Fuel economy (mpg)

Baseline Method:

$$\text{Baseline Emission} = EF \times (1 - R) \times VMT \times C$$

Where:

Baseline Emission	=	MT of Pollutant
EF	=	Running emission factor for pollutant at traveling speed, from EMFAC.
VMT	=	Vehicle miles traveled (VMT)
R	=	Additional reduction in EF due to regulation (see Table 1)
C	=	Unit conversion factor

Mitigation Method:

<u>Fully Electric Vehicle</u>

Vehicle will run solely on electricity. The indirect GHG emission from electricity generation is:

$$\text{Mitigated Emission} = \text{Utility} \times \frac{1}{FE} \times VMT \times ER \times C$$

Where:

Mitigated Emission = MT of CO_2e
Utility = Carbon intensity of Local Utility (CO_2e/kWh)
VMT = Vehicle miles traveled (VMT)
ER = Energy Ratio = 33.4 kWh/gallon-gasoline or 37.7 kWh/gallon-diesel
FE = Fuel Economy (mpg)
C = Unit conversion factor

Power Utility	Carbon-Intensity (lbs CO_2e/MWh)
LADW&P	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

Criteria pollutant emissions will be 100% reduced for equipment running solely on electricity.

Hybrid-Electric Vehicle

The Project Applicant has to determine the fuel consumption reduced from using the hybrid-electric vehicle. The emission reductions for all pollutants are the same as the fuel reduction.

Emission reductions can be calculated as:

$$\text{GHG Reduction\%} = 1 - \frac{\text{Mitigated Emission}}{\text{Running Emission}}$$

Emission Reduction Ranges and Variables:

See Table VT-3.1 below.

Discussion:

Using the methodology described above, only the running emission is considered. A hypothetical scenario for a gasoline fueled light duty automobile with catalytic converter in 2015 is illustrated below. The running CO_2 emission factor at 30 mph from an EMFAC run of the Sacramento county with temperature of 60F and relative humidity of 45% is 336.1 g/mile. From Table VT-3.1, there will be an additional reduction of 9.1% for the emission factor in 2015 due to Pavley standard. Assuming the automobile makes two trips of 60 mile each per day, then annual baseline emission from the automobile is:

$$336.1\times(100\% - 9.1\%)\times 2\times 365\times 60\times 10^{-6} = 13.4 \text{ MT/year}$$

Where 10^{-6} is the conversion factor from grams to MT. Assuming the current passenger car fuel economy of 27.5 mpg under the CAFE standards, and using the carbon-intensity factor for PG&E, the electric provider for the Sacramento region, the mitigated emission from replacing the automobile described above with electric vehicle would be:

$$\left(456\times\frac{2\times 365\times 60}{27.5}\times 33.4\times\frac{1}{2{,}204\times 10^{3}}\right) = 11.0 \text{ MT/year}$$

Therefore, the emission reduction is:

$$1-\frac{11.0}{13.4} = 17.9\%$$

Assumptions:

Data based upon the following references:

- California Air Resources Board. EMFAC2007. Available online at: http://www.arb.ca.gov/msei/onroad/latest_version.htm
- California Climate Action Registry (CCAR). 2009. General Reporting Protocol. Version 3.1. Available online at: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html
- California Climate Action Registry Reporting Online Tool. 2006 PUP Reports. Available online at: https://www.climateregistry.org/CARROT/public/reports.aspx
- US Department of Energy. 2010. Alternative and Advanced Fuels – Fuel Properties. Available online at: http://www.afdc.energy.gov/afdc/fuels/properties.html

Preferred Literature:

The amount of emissions avoided from using electric and hybrid vehicles can be calculated using CARB's EMFAC model, which provides state-wide and regional running emission factors for a variety of on-road vehicles in units of grams per mile [1]. Multiplying this factor by the vehicle miles traveled (VMT) gives the direct emissions. For criteria pollutant, emissions can be assumed to be 100% reduced from running on electricity. For GHG, assuming the same VMT, the electricity required to run the same vehicle fleet can be calculated by dividing by the fuel economy (mph) and multiplying the gasoline-electric energy ratio obtained from the US Department of Energy [2]. Multiplying this value by the carbon-intensity factor of the local utility gives the amount of indirect GHG emissions associated with electric vehicles. The GHG emissions reduction associated with this mitigation measure is therefore the difference in emissions from these two scenarios.

Alternative Literature:

None

Notes:

[1] California Air Resources Board. EMFAC2007. Available online at: http://www.arb.ca.gov/msei/onroad/latest_version.htm
[2] US Department of Energy. 2010. Alternative and Advanced Fuels – Fuel Properties. Available online at: http://www.afdc.energy.gov/afdc/fuels/properties.html

Other Literature Reviewed:

None

Table VT-3.1
Reduction in EMFAC Running Emission Factor from New Regulations

Year	Vehicle Class	Reduction	Pollutant	Regulation
2010	LDA/LDT/MDV	0.4%	CO_2	Pavley Standard
2011	LDA/LDT/MDV	1.6%	CO_2	Pavley Standard
2012	LDA/LDT/MDV	3.5%	CO_2	Pavley Standard
2013	LDA/LDT/MDV	5.3%	CO_2	Pavley Standard
2014	LDA/LDT/MDV	7.1%	CO_2	Pavley Standard
2015	LDA/LDT/MDV	9.1%	CO_2	Pavley Standard
2016	LDA/LDT/MDV	11.0%	CO_2	Pavley Standard
2017	LDA/LDT/MDV	13.1%	CO_2	Pavley Standard
2018	LDA/LDT/MDV	15.5%	CO_2	Pavley Standard
2019	LDA/LDT/MDV	17.9%	CO_2	Pavley Standard
2020	LDA/LDT/MDV	20.3%	CO_2	Pavley Standard
2011	Other Buses	21.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	School Bus	19.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT Agriculture	17.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT CA International Registration Plan	4.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT Instate	6.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT Out-of-state	4.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Agriculture	23.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT CA International Registration Plan	1.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Non-neighboring Out-of-state	0.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Neighboring Out-of-state	2.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Singleunit	10.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Tractor	9.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	Other Buses	25.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	Power Take Off	28.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	School Bus	45.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	MHDDT Agriculture	20.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	MHDDT CA International Registration Plan	12.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	MHDDT Instate	11.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles

Year	Vehicle Class	Reduction	Pollutant	Regulation
				Regulation
2012	MHDDT Out-of-state	12.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Agriculture	29.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT CA International Registration Plan	8.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Non-neighboring Out-of-state	15.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Neighboring Out-of-state	15.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Drayage at Other Facilities	9.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Drayage in Bay Area	9.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Drayage near South Coast	7.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Singleunit	14.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Tractor	13.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	Other Buses	45.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	Power Take Off	57.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	School Bus	68.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT Agriculture	31.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT CA International Registration Plan	55.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT Instate	64.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT Out-of-state	55.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Agriculture	48.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT CA International Registration Plan	60.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Non-neighboring Out-of-state	50.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Neighboring Out-of-state	63.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Drayage at Other Facilities	67.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Drayage in Bay Area	65.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Drayage near South Coast	51.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2013	HHDDT Singleunit	66.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Tractor	69.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	Other Buses	53.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	Power Take Off	63.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	School Bus	71.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Agriculture	33.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT CA International Registration Plan	65.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Instate	77.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Out-of-state	65.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Agriculture	52.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT CA International Registration Plan	63.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Non-neighboring Out-of-state	46.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Neighboring Out-of-state	64.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Singleunit	79.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Tractor	79.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Utility	4.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	Other Buses	49.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	Power Take Off	61.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	School Bus	71.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Agriculture	34.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT CA International Registration Plan	60.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Instate	74.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Out-of-state	60.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2015	HHDDT Agriculture	53.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT CA International Registration Plan	55.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Non-neighboring Out-of-state	37.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Neighboring Out-of-state	55.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Singleunit	77.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Tractor	76.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Utility	4.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	Other Buses	43.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	Power Take Off	75.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	School Bus	70.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Agriculture	32.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT CA International Registration Plan	56.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Instate	73.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Out-of-state	56.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Agriculture	51.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT CA International Registration Plan	45.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Non-neighboring Out-of-state	27.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Neighboring Out-of-state	46.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Singleunit	75.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Tractor	73.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Utility	4.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	Other Buses	36.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	Power Take Off	71.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	School Bus	67.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2017	MHDDT Agriculture	55.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT CA International Registration Plan	52.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT Instate	70.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT Out-of-state	52.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Agriculture	58.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT CA International Registration Plan	37.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Non-neighboring Out-of-state	18.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Neighboring Out-of-state	37.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Singleunit	73.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Tractor	70.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Utility	3.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	Other Buses	31.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	Power Take Off	67.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	School Bus	74.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Agriculture	53.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT CA International Registration Plan	47.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Instate	68.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Out-of-state	47.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Agriculture	55.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT CA International Registration Plan	30.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Non-neighboring Out-of-state	11.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Neighboring Out-of-state	30.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Singleunit	72.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2018	HHDDT Tractor	67.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Utility	3.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	Other Buses	27.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	Power Take Off	76.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	School Bus	73.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Agriculture	53.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT CA International Registration Plan	42.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Instate	65.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Out-of-state	42.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Agriculture	54.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT CA International Registration Plan	24.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Non-neighboring Out-of-state	5.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Neighboring Out-of-state	24.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Singleunit	69.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Tractor	64.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Utility	3.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	Other Buses	23.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	Power Take Off	74.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	School Bus	71.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Agriculture	52.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT CA International Registration Plan	37.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Instate	60.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Out-of-state	37.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Utility	0.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2020	HHDDT Agriculture	52.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT CA International Registration Plan	19.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Non-neighboring Out-of-state	3.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Neighboring Out-of-state	20.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Singleunit	66.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Tractor	61.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Utility	2.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	Other Buses	21.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	Power Take Off	79.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	School Bus	68.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Agriculture	51.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT CA International Registration Plan	33.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Instate	57.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Out-of-state	33.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Utility	5.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Agriculture	50.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT CA International Registration Plan	16.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Non-neighboring Out-of-state	3.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Neighboring Out-of-state	16.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Drayage at Other Facilities	10.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Drayage in Bay Area	9.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Drayage near South Coast	9.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Singleunit	64.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Tractor	59.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Utility	5.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2022	Other Buses	20.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	Power Take Off	79.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	School Bus	66.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Agriculture	50.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT CA International Registration Plan	28.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Instate	53.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Out-of-state	28.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Utility	6.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Agriculture	49.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT CA International Registration Plan	13.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Non-neighboring Out-of-state	1.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Neighboring Out-of-state	14.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Drayage at Other Facilities	10.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Drayage in Bay Area	8.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Drayage near South Coast	8.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Singleunit	61.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Tractor	55.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Utility	5.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	Other Buses	18.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	Power Take Off	74.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	School Bus	64.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT Agriculture	79.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT CA International Registration Plan	23.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT Instate	48.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT Out-of-state	23.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2023	MHDDT Utility	7.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Agriculture	68.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT CA International Registration Plan	11.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Non-neighboring Out-of-state	1.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Neighboring Out-of-state	11.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Drayage at Other Facilities	9.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Drayage in Bay Area	8.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Drayage near South Coast	8.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Singleunit	56.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Tractor	51.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Utility	4.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	Other Buses	15.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	Power Take Off	68.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	School Bus	61.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Agriculture	77.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT CA International Registration Plan	20.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Instate	43.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Out-of-state	20.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Utility	5.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Agriculture	65.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT CA International Registration Plan	9.1%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Non-neighboring Out-of-state	0.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Neighboring Out-of-state	9.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Drayage at Other Facilities	9.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Drayage in Bay Area	7.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2024	HHDDT Drayage near South Coast	7.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Singleunit	50.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Tractor	46.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Utility	3.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	Other Buses	13.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	Power Take Off	62.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	School Bus	58.2%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Agriculture	75.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT CA International Registration Plan	15.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Instate	37.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Out-of-state	15.3%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Utility	3.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Agriculture	62.7%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT CA International Registration Plan	6.8%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Non-neighboring Out-of-state	0.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Neighboring Out-of-state	7.0%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Drayage at Other Facilities	8.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Drayage in Bay Area	7.5%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Drayage near South Coast	7.6%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Singleunit	44.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Tractor	42.9%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Utility	2.4%	PM2.5	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT CA International Registration Plan	1.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT Instate	2.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	MHDDT Out-of-state	1.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2011	HHDDT CA International Registration Plan	0.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Non-neighboring Out-of-state	0.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Neighboring Out-of-state	1.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Singleunit	4.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2011	HHDDT Tractor	3.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	Power Take Off	13.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	School Bus	2.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	MHDDT CA International Registration Plan	1.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	MHDDT Instate	2.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	MHDDT Out-of-state	1.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT CA International Registration Plan	0.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Non-neighboring Out-of-state	0.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Neighboring Out-of-state	0.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Singleunit	3.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2012	HHDDT Tractor	3.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	Other Buses	18.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	Power Take Off	34.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	School Bus	4.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT Agriculture	5.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT CA International Registration Plan	12.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT Instate	25.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	MHDDT Out-of-state	12.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Agriculture	10.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT CA International Registration Plan	8.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Non-neighboring Out-of-state	1.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2013	HHDDT Neighboring Out-of-state	8.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Singleunit	33.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2013	HHDDT Tractor	28.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	Other Buses	40.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	Power Take Off	37.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	School Bus	6.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Agriculture	9.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT CA International Registration Plan	22.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Instate	34.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Out-of-state	22.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	MHDDT Utility	0.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Agriculture	17.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT CA International Registration Plan	13.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Non-neighboring Out-of-state	4.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Neighboring Out-of-state	14.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Singleunit	45.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Tractor	36.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2014	HHDDT Utility	1.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	Other Buses	52.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	Power Take Off	33.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	School Bus	6.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Agriculture	18.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT CA International Registration Plan	20.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Instate	31.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	MHDDT Out-of-state	20.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2015	MHDDT Utility	0.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Agriculture	27.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT CA International Registration Plan	11.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Non-neighboring Out-of-state	2.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Neighboring Out-of-state	12.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Singleunit	42.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Tractor	34.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2015	HHDDT Utility	1.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	Other Buses	54.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	Power Take Off	43.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	School Bus	4.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Agriculture	19.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT CA International Registration Plan	22.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Instate	32.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Out-of-state	22.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	MHDDT Utility	0.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Agriculture	29.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT CA International Registration Plan	11.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Non-neighboring Out-of-state	3.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Neighboring Out-of-state	13.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Singleunit	43.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Tractor	35.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2016	HHDDT Utility	1.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	Other Buses	59.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	Power Take Off	38.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2017	MHDDT Agriculture	43.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT CA International Registration Plan	27.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT Instate	35.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT Out-of-state	27.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	MHDDT Utility	1.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Agriculture	45.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT CA International Registration Plan	14.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Non-neighboring Out-of-state	7.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Neighboring Out-of-state	17.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Singleunit	46.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Tractor	38.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2017	HHDDT Utility	1.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	Other Buses	56.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	Power Take Off	32.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	School Bus	7.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Agriculture	41.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT CA International Registration Plan	26.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Instate	41.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Out-of-state	26.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	MHDDT Utility	1.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Agriculture	42.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT CA International Registration Plan	15.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Non-neighboring Out-of-state	4.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Neighboring Out-of-state	16.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Singleunit	51.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2018	HHDDT Tractor	43.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2018	HHDDT Utility	1.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	Other Buses	52.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	Power Take Off	38.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	School Bus	6.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Agriculture	40.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT CA International Registration Plan	22.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Instate	38.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Out-of-state	22.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	MHDDT Utility	1.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Agriculture	40.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT CA International Registration Plan	12.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Non-neighboring Out-of-state	2.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Neighboring Out-of-state	13.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Singleunit	48.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Tractor	41.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2019	HHDDT Utility	1.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	Other Buses	49.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	Power Take Off	41.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	School Bus	5.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Agriculture	38.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT CA International Registration Plan	19.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Instate	34.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Out-of-state	19.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	MHDDT Utility	1.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2020	HHDDT Agriculture	38.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT CA International Registration Plan	9.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Non-neighboring Out-of-state	1.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Neighboring Out-of-state	10.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Singleunit	45.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Tractor	39.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2020	HHDDT Utility	1.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	Other Buses	48.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	Power Take Off	51.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	School Bus	4.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Agriculture	38.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT CA International Registration Plan	21.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Instate	41.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Out-of-state	21.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	MHDDT Utility	33.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Agriculture	37.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT CA International Registration Plan	9.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Non-neighboring Out-of-state	1.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Neighboring Out-of-state	9.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Drayage at Other Facilities	40.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Drayage in Bay Area	41.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Drayage near South Coast	39.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Singleunit	54.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Tractor	45.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2021	HHDDT Utility	21.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2022	Other Buses	48.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	Power Take Off	60.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	School Bus	3.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Agriculture	40.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT CA International Registration Plan	20.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Instate	41.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Out-of-state	20.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	MHDDT Utility	28.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Agriculture	40.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT CA International Registration Plan	8.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Non-neighboring Out-of-state	1.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Neighboring Out-of-state	9.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Drayage at Other Facilities	39.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Drayage in Bay Area	40.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Drayage near South Coast	39.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Singleunit	54.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Tractor	45.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2022	HHDDT Utility	18.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	Other Buses	47.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	Power Take Off	54.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	School Bus	2.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT Agriculture	65.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT CA International Registration Plan	18.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT Instate	39.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	MHDDT Out-of-state	18.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2023	MHDDT Utility	25.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Agriculture	59.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT CA International Registration Plan	7.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Non-neighboring Out-of-state	1.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Neighboring Out-of-state	8.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Drayage at Other Facilities	38.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Drayage in Bay Area	39.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Drayage near South Coast	38.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Singleunit	52.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Tractor	44.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2023	HHDDT Utility	16.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	Other Buses	43.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	Power Take Off	47.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	School Bus	1.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Agriculture	63.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT CA International Registration Plan	15.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Instate	33.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Out-of-state	15.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	MHDDT Utility	19.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Agriculture	56.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT CA International Registration Plan	6.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Non-neighboring Out-of-state	0.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Neighboring Out-of-state	6.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Drayage at Other Facilities	38.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Drayage in Bay Area	39.4%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

Year	Vehicle Class	Reduction	Pollutant	Regulation
2024	HHDDT Drayage near South Coast	37.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Singleunit	47.2%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Tractor	39.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2024	HHDDT Utility	13.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	Other Buses	39.0%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	Power Take Off	39.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	School Bus	1.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Agriculture	61.1%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT CA International Registration Plan	11.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Instate	28.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Out-of-state	11.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	MHDDT Utility	13.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Agriculture	53.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT CA International Registration Plan	4.6%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Non-neighboring Out-of-state	0.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Neighboring Out-of-state	4.8%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Drayage at Other Facilities	37.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Drayage in Bay Area	38.9%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Drayage near South Coast	37.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Singleunit	41.5%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Tractor	35.7%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation
2025	HHDDT Utility	10.3%	NOx	On-Road Heavy-Duty Diesel Vehicles Regulation

4.0 Water

4.1 Water Supply

4.1.1 Use Reclaimed Water

Range of Effectiveness: Up to 40% in Northern California and up to 81% in Southern California

Measure Description:

California water supplies come from ground water, surface water, and from reservoirs, typically fed from snow melt. Some sources of water are transported over long distances, and sometimes over terrain to reach the point of consumption. Transporting water can require a significant amount of electricity. In addition, treating water to potable standards can also require substantial amounts of energy. Reclaimed water is water reused after wastewater treatment for non-potable uses instead of returning the water to the environment. This is different than gray water, which has not been through wastewater treatment. Reclaimed non-potable water requires significantly less energy to collect, treat, and redistribute water to the point of local areas of non-potable water consumption. Since less energy is required to provide reclaimed water, fewer GHGs will be associated with reclaimed water use compared to the average California water supply use.

This measure describes how to calculate GHG savings from using reclaimed water instead of new potable water supplies for outdoor water uses or other non-potable water uses. The baseline scenario document outlines average Northern and Southern California electricity-use water factors, and assumes that all water is treated to potable standards.

Measure Applicability:

- Non-potable water use

Inputs:

The following information needs to be provided by the Project Applicant:

- Reclaimed water use (million gallons)
- Total non-potable water use (million gallons)

Baseline Method:

$$\text{GHG emissions} = \text{Water}_{\text{non-potable total}} \times \text{Electricity}_{\text{baseline}} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e
$Water_{non\text{-}potable\ total}$ = Total volume of non-potable water used (million gallons)
Provided by Applicant
$Electricity_{baseline}$ = Electricity required to supply, treat, and distribute water (kWh/million gallons)
Northern California Average: 3,500 kWh/million gallons
Southern California Average: 11,111 kWh/million gallons
Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

A million gallons of reclaimed water would use an average of 2,100 kWh electricity per million gallons of water (range of 1,200 to 3,000 kWh). Therefore the percent reduction in GHG emissions associated with implementing reclaimed water usage is:

$$\text{GHG emission reduction} = \frac{Water_{reclaimed}}{Water_{non\text{-}potable\ total}} \times \frac{Electricity_{baseline} - Electricity_{reclaimed}}{Electricity_{baseline}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for non-potable water use.
$Water_{reclaimed}$ = Total volume of reclaimed water used (million gallons)
Provided by Applicant
$Water_{non\text{-}potable\ total}$ = Total volume of non-potable water used (million gallons)
Provided by Applicant
$Electricity_{reclaimed}$ = Electricity required to treat and distribute reclaimed water (2,100 kWh/million gallons)
$Electricity_{baseline}$ = Electricity required to supply and distribute water
Northern California Average: 3,500 kWh/million gallons
Southern California Average: 11,111 kWh/million gallons

Therefore, for projects in Northern California, the reduction in GHG emissions is:

$$\text{GHG emission reduction} = \frac{Water_{reclaimed}}{Water_{non\text{-}potable\ total}} \times \frac{(3{,}500 - 2{,}100)}{3{,}500} = \frac{Water_{reclaimed}}{Water_{non\text{-}potable\ total}} \times 0.40$$

And for projects in Southern California, the reduction in GHG emissions is:

$$\text{GHG emission reduction} = \frac{Water_{reclaimed}}{Water_{non\text{-}potable\ total}} \times \frac{(11{,}111 - 2{,}100)}{11{,}111} = \frac{Water_{reclaimed}}{Water_{non\text{-}potable\ total}} \times 0.81$$

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	N. California: Up to 40% if assuming 100% reclaimed water S. California: Up to 81% if assuming 100% reclaimed water Percent reduction would scale down linearly as the percent reclaimed water decreases.
All other pollutants	Not quantified[82]

Discussion:

If the Project Applicant uses 100 million gallons of non-potable water for a project in Northern California, they would calculate baseline emissions as described in the baseline methodologies document. If the applicant then selects to mitigate water by committing to using 40 million gallons of reclaimed water in place of the usual water source, the applicant would reduce the amount of GHG emissions associated with outdoor water use by 16%

$$\text{GHG Emission Reduced} = \frac{40}{100} \times 0.40 = 0.16 \text{ or } 16\%$$

Assumptions:

Data based upon the following reference:

[1] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

Preferred Literature:

GHG emissions from the mitigated scenario should be calculated based on the 2006 CEC report, which presents regional baseline electricity-use water factors and a factor of 1,200-3,000 kWh per million gallons for reclaimed water. GHG emissions are calculated by multiplying the amount of water (million gallons) by the electricity-use water factor (kWh per million gallons) by the carbon-intensity of the local utility (CO_2e per kWh). The GHG emissions reductions associated with this mitigation measure are

82 Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

associated with the difference between the baseline potable water electricity-use water factor and the mitigated scenario.

Alternative Literature:

None

Other Literature Reviewed:

None

4.1.2 Use Gray Water

Range of Effectiveness: Up to 100% of outdoor water GHG emissions if outdoor water use is replaced completely with graywater

Measure Description:

California water supplies come from ground water, surface water, and from reservoirs, typically fed from snow melt. Some sources of water are transported over long distances, and sometimes over terrain to reach the point of consumption. Transporting water can require a significant amount of electricity. In addition, treating water to potable standards can also require substantial amounts of energy. Untreated wastewater generated from bathtubs, showers, bathroom wash basins, and clothes washing machines is known as graywater and is collected and distributed onsite for irrigation of landscape and mulch. Since graywater does not require treatment or energy to redistribute it onsite, there are negligible GHG emissions associated with the use of graywater.

This measure describes how to calculate GHG savings from using graywater instead of new potable water supplies for landscape irrigation and other outdoor uses. The baseline scenario document outlines average Northern and Southern California electricity-use water factors, and assumes that all water is non-potable.

Measure Applicability:

- Outdoor water use

Inputs:

The following information needs to be provided by the Project Applicant:

- Graywater use[83] (million gallons), or:
  - Type of graywater system, which must be compliant with the California Plumbing Code, and
  - Number of residents in homes with compliant graywater systems
- Total outdoor water use (million gallons)

Baseline Method:

$$\text{GHG emissions} = \text{Water}_{\text{outdoor total}} \times \text{Electricity}_{\text{baseline}} \times \text{Utility}$$

[83] Note that this is the amount of graywater used, which may be less than the amount of graywater generated. A project may generate and collect more graywater than is needed for landscape irrigation. The Project Applicant should only take credit for the amount of potable water which is displaced by graywater. The amount of landscape irrigation water demand (graywater demand) is calculated according to the methodology described in WUW-3 and the baseline methodologies document.

Where:

GHG emissions = MT CO_2e
$Water_{outdoor\ total}$ = Total volume of outdoor water used (million gallons)
Provided by Applicant
$Electricity_{baseline}$ = Electricity required to supply, treat, and distribute water (kWh/million gallons)
Northern California Average: 3,500 kWh/million gallons
Southern California Average: 11,111 kWh/million gallons
Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

If the Project Applicant cannot provide the total amount of graywater used, the graywater use can be calculated based on the following equation:

$Water_{graywater}$ =

$$\left[\left(25\times Residents_{graywater\text{-}sbw}\right)+\left(15\times Residents_{graywater\text{-}laundry}\right)\right]\frac{gallons}{day}\times\frac{365\,days}{year}\times\frac{1\,million\,gallons}{10^{6}\,gallons}$$

Where:

$Water_{graywater}$ = Total volume of graywater used (million gallons).
$Residents_{graywater\text{-}sbw}$ = Total number of residents in homes with graywater systems based on graywater generated from showers, bathtubs, and wash basins
25 = gallons per day per residential occupant from showers, bathtubs, and washbasins [1]
$Residents_{graywater\text{-}laundry}$ = Total number of residents in homes with graywater systems based on graywater generated from laundry machines
15 = gallons per day per residential occupant from laundry machines [1]

The percent reduction in GHG emissions associated with implementing graywater usage is therefore:

$$\text{GHG emission reduction} = \frac{Water_{graywater}}{Water_{oudoor\ total}}\times\frac{Electricity_{baseline}-Electricity_{graywater}}{Electricity_{baseline}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for outdoor water use.
$Water_{graywater}$ = Total volume of graywater used (million gallons)
Provided by Applicant or calculated using equation above
$Water_{outdoor\ total}$ = Total volume of outdoor water used (million gallons)
Provided by Applicant

$Electricity_{graywater}$ = Electricity required to distribute graywater (0 kWh/million gallons)[84]

$Electricity_{baseline}$ = Electricity required to supply, treat, and distribute water
Northern California Average: 3,500 kWh/million gallons [2]
Southern California Average: 11,111 kWh/million gallons [2]

Therefore, for projects in Northern California, the reduction in GHG emissions is:

$$\text{GHG emission reduction} = \frac{Water_{graywater}}{Water_{outdoor\ total}} \times \frac{(3{,}500-0)}{3{,}500} = \frac{Water_{graywater}}{Water_{outdoor\ total}}$$

And for projects in Southern California, the reduction in GHG emissions is:

$$\text{GHG emission reduction} = \frac{Water_{graywater}}{Water_{outdoor\ total}} \times \frac{(11{,}111-0)}{11{,}111} = \frac{Water_{graywater}}{Water_{outdoor\ total}}$$

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	N. California: Up to 100% if assuming 100% graywater S. California: Up to 100% if assuming 100% graywater Percent reduction would scale down linearly as the percent reclaimed water decreases.
All other pollutants	Not Quantified[85]

Discussion:

If the Project Applicant uses 100 million gallons of water for outdoor uses in a project in Northern California, they would calculate baseline emissions as described above and in the baseline methodologies document. If the Project Applicant then selects to mitigate water by committing to establishing graywater systems based on graywater recovery from laundry machines in 500 homes with an average of 3 people in each home, the amount of graywater used is then:

[84] In some cases the distribution of graywater will require some amount of electricity; for example, graywater generated at residences and pumped to a nearby park. In those cases, $Electricity_{graywater}$ will be non-zero.

[85] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

$Water_{graywater}$ =

$$[(25 \times 0) + (15 \times 500 \times 3)]\frac{\text{gallons}}{\text{day}} \times \frac{365\,\text{days}}{\text{year}} \times \frac{1\,\text{milliongallons}}{10^6\ \text{gallons}} = 8.2 \text{ million gallons}$$

Then the Project Applicant would reduce the amount of GHG emissions associated with outdoor water use by 8.2%

$$\text{GHG Emission Reduced} = \frac{8.2}{100} = 0.082 \text{ or } 8.2\%$$

Assumptions:

Data based upon the following references:

[1] 2007 CPC, Title 24, Part 5, Chapter 16A, Part I – Nonpotable Water Reuse Systems. Available online at: http://www.hcd.ca.gov/codes/shl/2007CPC_Graywater_Complete_2-2-10.pdf

[2] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

Preferred Literature:

Assuming a compliant graywater system is installed, Part 1606A.0 of the California Plumbing Code (CPC) estimates 25 gallons per day per residential occupant of graywater generation from showers, bathtubs, and wash basins, and 15 gallons per day per residential occupant of graywater discharge from laundry machines. Electricity and CO_2 savings from using graywater are determined by comparing to the emissions that would have been associated with the water use if the graywater demand had instead been supplied by potable water. The baseline emissions should be calculated based on the 2006 CEC methodology. A development may generate and collect more graywater than is needed for landscape irrigation. A Project Applicant should only take credit for emissions reductions associated with the amount of potable water which is displaced by graywater. The amount of landscape irrigation water demand (graywater demand) is calculated according to the methodology described in the baseline methodologies document and WUW-3.

Alternative Literature:

None

Other Literature Reviewed:

[3] Arizona Department of Environmental Quality. 2009. Using Gray Water at Home Brochure. Available online at: http://www.azdeq.gov/environ/water/permits/download/graybro.pdf

[4] Arizona Department of Water Resources. Technologies – Irrigation, Rainwater Harvesting, Gray Water Reuse and Artificial Turf. Available online at: http://www.azwater.gov/AzDWR/StatewidePlanning/Conservation2/Technologies/Tech%20pages%20templates/LandscapeIrrigation.htm. Accessed February 2010.

[5] AAC, Title 18, Chapter 9, Article 7. Direct Reuse of Reclaimed Water. Available online at: http://www.azsos.gov/public_services/title_18/18-09.pdf

[6] Oasis Design. Graywater Information Central. Available online at: http://www.graywater.net/. Accessed February 2010.

4.1.3 Use Locally Sourced Water Supply

Range of Effectiveness: 0 – 60% for Northern and Central California, 11 – 75% for Southern California

Measure Description:

California water supplies come from ground water, surface water, and from reservoirs, typically fed from snow melt. Some sources of water are transported over long distances, and sometimes over terrain to reach the point of consumption. Transporting water can require a significant amount of electricity. Using locally-sourced water or water from less energy-intensive sources reduces the electricity and indirect CO_2 emissions associated with water supply and transport.

This measure describes how to calculate GHG savings from using local or less energy-intensive water sources instead of water from the typical mix of Northern and Southern California sources. According to the 2006 CEC report [1], water in Northern California (which also includes the Central Coast and San Joaquin Valley for this study) is primarily supplied by deliveries from the State Water Project and groundwater, and to a lesser extent is supplied by the gravity-dominated systems of Hetch Hetchy and the Mokelumne Aqueduct. In contrast, water imported from the State Water Project is Southern California's dominant water source. The baseline scenario uses average Northern and Southern California electricity intensity factors as reported in 2006 CEC and detailed in the Baseline Method below.

Measure Applicability:

- Indoor (potable) and outdoor (non-potable) water use

Inputs:

- Total potable and non-potable water use (million gallons)

Baseline Method:

$$\text{GHG emissions} = \text{Water}_{\text{baseline}} \times \text{Electricity}_{\text{baseline}} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$\text{Water}_{\text{baseline}}$ = Total volume of water used (million gallons)
Provided by Applicant

$\text{Electricity}_{\text{baseline}}$ = Electricity required to supply, treat, and distribute water (and for indoor uses, the electricity required to treat the resulting wastewater) (kWh/million gallons)
Indoor Uses:
Northern California Average: 5,411 kWh/million gallons [1]
Southern California Average: 13,022 kWh/million gallons [1]

Outdoor Uses:
Northern California Average: 3,500 kWh/million gallons [1]
Southern California Average: 11,111 kWh/million gallons [1]
Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

Table WSW-3.1 shows that water from local or nearby groundwater basins, nearby surface water, and gravity-dominated systems have smaller energy-intensity factors than the average Northern and Southern California energy-intensity factors. The Project Applicant should use Table WSW-3.1 to identify the outdoor and indoor electricity intensity factors associated with the Project's water source(s). The GHG emission reduction is then calculated as follows:

$$\text{GHG emission reduction} = \frac{\text{Water}_{\text{mitigated}}}{\text{Water}_{\text{baseline}}} \times \frac{\text{Electricity}_{\text{baseline}} - \text{Electricity}_{\text{mitigated}}}{\text{Electricity}_{\text{baseline}}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for water use
$\text{Water}_{\text{mitigated}}$ = Volume of water to be supplied from the mitigated (local or less energy-intensive) source
Provided by Applicant
$\text{Water}_{\text{baseline}}$ = Total volume of water used (million gallons)
Provided by Applicant
$\text{Electricity}_{\text{mitigated}}$ = Electricity required to distribute water for Project from mitigated (local or less-energy intensive) source
$\text{Electricity}_{\text{baseline}}$ = Baseline electricity required to supply, treat, and distribute water (and for indoor uses, the electricity required to treat the resulting wastewater) (kWh/million gallons)
Indoor Uses:
Northern California Average: 5,411 kWh/million gallons [1]
Southern California Average: 13,022 kWh/million gallons [1]
Outdoor Uses:
Northern California Average: 3,500 kWh/million gallons [1]
Southern California Average: 11,111 kWh/million gallons [1]

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Assuming 100% of water is sourced locally: Indoor Uses: • 0-40% reduction for Northern and Central California • 11-64% reduction for Southern California Outdoor Uses: • 0-60% reduction for Northern and Central California • 12-75% reduction for Southern California
All other pollutants	Not Quantified[86]

Discussion:

Assume a Project is located in Southern California within the Chino Basin and has a total indoor water demand of 100 million gallons. Assume 70 million gallons will be sourced from a water district which obtains its water from the typical Southern California water sources. Therefore, for these 70 million gallons the baseline outdoor water electricity-intensity factor for Southern California is used. Assume that the Project Applicant chooses to mitigate the Project by sourcing the remaining 30 million gallons from the Chino Basin. The expected GHG emission reduction is then:

$$\text{GHG Emission Reduced} = \frac{30}{100} \times \frac{11{,}111 - 4{,}298}{11{,}111} = 0.18 \text{ or } 18\%$$

Assumptions:

Data based upon the following reference:

[1] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

86 Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

[2]CEC. 2005. California's Water-Energy Relationship. Final Staff Report. CEC 700-2005-011-SF. Available online at: http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF

[3]NRDC. 2004. Energy Down the Drain: The Hidden Costs of California's Water Supply. Prepared by NRDC and the Pacific Institute. Available online at: http://www.nrdc.org/water/conservation/edrain/edrain.pdf

Preferred Literature:

Electricity and CO_2 savings from using locally-sourced water or water from sources which require below-average electricity intensities for supply and conveyance (such as gravity-dominated systems or local groundwater basins that are not very deep) are determined by comparing to the emissions that would have occurred if the water had instead been conveyed from typical water sources for the region. According to the 2005 and 2006 CEC reports [1,2], the typical mix of water sources in Northern and Central California is the State Water Project, groundwater, and gravity-dominated systems such as Hetch Hetchy and the Mokelumne Aqueduct. The majority of water in Southern California is supplied by imports from the State Water Project and the Colorado River Aqueduct. Examples of mitigated electricity-intensity factors are shown in Table WSW-3.1 and are based on data provided in 2006 CEC [1], 2005 CEC [2], and 2004 NRDC [3]. GHG emissions are calculated by multiplying the amount of water (million gallons) by the electricity-use water factor (kWh per million gallons) by the carbon-intensity of the local utility (CO_2e per kWh). The GHG emissions reductions associated with this mitigation measure are associated with the difference between the baseline water electricity-intensity factor and the mitigated electricity-intensity factor.

Alternative Literature:

None

Other Literature Reviewed:

None

Table WSW-3.1
Energy Intensity of Water Use (kWh/MG) by Region

REGION	WATER USE SEGMENT						
	Supply & Conveyance[1]		Treatment[1]	Distribution[1]	*OUTDOOR TOTAL (NON-POTABLE)*[2]	Wastewater Treatment[1]	*INDOOR TOTAL (POTABLE)*[3]
Northern California	SWP to Bay Area *surface water*	3,150	111	1,272	***4,533***	1,911	***6,444***
	Hetch Hetchy to Bay Area *gravity dominated*	0	111	1,272	***1,383***	1,911	***3,294***
	Mokelumne Aqueduct to Bay Area *gravity dominated*	160	111	1,272	***1,543***	1,911	***3,454***
Central California	SWP to Central Coast *surface water*	3,150	111	1,272	***4,533***	1,911	***6,444***
	SWP to San Joaquin Valley *surface water*	1,510	111	1,272	***2,893***	1,911	***4,804***
	San Joaquin River Basin & Central Coast[4] *groundwater*	896	111	1,272	***2,279***	1,911	***4,190***
	Tulare Lake Basin[4] *groundwater*	537	111	1,272	***1,920***	1,911	***3,831***
	Fresno and Kings Counties (Westlands WD)[4] *groundwater*	2,271	111	1,272	***3,654***	1,911	***5,565***
Southern California	SWP to L.A. Basin *surface water*	8,325	111	1,272	***9,708***	1,911	***11,619***
	Colorado River Aqueduct to L.A. Basin *surface water*	6,140	111	1,272	***7,523***	1,911	***9,434***
	Chino Basin[5] *groundwater*	2,915	111	1,272	***4,298***	1,911	***6,209***
	Los Angeles[4] *groundwater*	1,780	111	1,272	***3,163***	1,911	***5,074***
	San Diego County (Sweetwater WD)[4] *groundwater*	1,433	111	1,272	***2,816***	1,911	***4,727***
	San Diego County (Yuima WD)[4]	2,029	111	1,272	***3,412***	1,911	***5,323***

REGION	WATER USE SEGMENT						
	Supply & Conveyance[1]		Treatment[1]	Distribution[1]	*OUTDOOR TOTAL (NON-POTABLE)*[2]	Wastewater Treatment[1]	*INDOOR TOTAL (POTABLE)*[3]
	groundwater						
State-wide	Local / Intrabasin	120	111	1,272	***1,503***	1,911	***3,414***
	Groundwater	4.45 kWh / MG / foot of well depth	111	1,272	***TBC***	1,911	***TBC***
	Ocean Desalination	13,800	111	1,272	***15,183***	1,911	***17,094***
	Brackish Water Desalination	3,230	111	1,272	***4,613***	1,911	***6,524***

Abbreviations:
CEC - California Energy Commission
kWh - kilowatt hour
MG - million gallons
NRDC - Natural Resources Defense Council
SWP - State Water Project
TBC - to be calculated based on well depth
WD - Water District

Notes:
1. Treatment, Distribution, and Wastewater Treatment electricity-intensity factors from 2006 CEC. Supply & Conveyance electricity-intensity factors from 2006 CEC unless otherwise noted.
2. Outdoor (Non-Potable) electricity-intensity factor is the sum of the Supply & Conveyance, Treatment, and Distribution electricity-intensity factors.
3. Indoor (Potable) electricity-intensity factor is the sum of the Supply & Conveyance, Treatment, Distribution, and Wastewater Treatment electricity-intensity factors.
4. Supply & Conveyance electricity-intensity factor from 2004 NRDC.
5. Supply & Conveyance electricity-intensity factor from 2005 CEC.

Sources:
CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

CEC. 2005. California's Water-Energy Relationship. Final Staff Report. CEC 700-2005-011-SF. Available online at: http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF

NRDC. 2004. Energy Down the Drain: The Hidden Costs of California's Water Supply. Prepared by NRDC and the Pacific Institute. Available online at: http://www.nrdc.org/water/conservation/edrain/edrain.pdf

4.2 Water Use

4.2.1 Install Low-Flow Water Fixtures

Range of Effectiveness: 20% of GHG emissions associated with indoor Residential water use; 17-31% of GHG emissions associated with Non-Residential indoor water use.

Measure Description:

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Installing low-flow or high-efficiency water fixtures in buildings reduces water demand, energy demand, and associated indirect GHG emissions.

This measure describes how to calculate GHG savings from installing low-flow water toilets, urinals, showerheads, or faucets, or high-efficiency clothes washers and dishwashers in residential and commercial buildings. To take credit for this mitigation measure, the Project Applicant must know the total expected indoor water demand before and after installation of low-flow or high-efficiency water fixtures. If expected water demand after implementation of the mitigation measure is not known, it can be calculated based on the information provided below. Water flow rates presented here in Tables WUW-1.1 and WUW-1.3 are based on technical specifications in the California Code of Regulations Title 20 (Appliance Efficiency Regulations) [2], Title 24 (California Green Building Standards Code) [1] and ENERGY STAR [5-8]. Indoor water end-uses for residential and commercial buildings presented here in Tables WUW-1.1 and WUW-1.2 are based on data provided in a 2003 report by the Pacific Institute for Studies in Development, Environment, and Security [3]. This report incorporates data from the most comprehensive end-use survey available to date, the 1999 Residential End Uses of Water survey published by the American Water Works Association [4], as well as California-specific population, water, and appliance data. California-specific data includes local utility water use and market penetration rates of low-flow and high-efficiency water fixtures.

The baseline scenario document describes the method to calculate baseline GHG emissions. It provides average Northern and Southern California electricity-use water factors and assumes that all water is treated to potable standards.

The percent reduction in GHG emissions is calculated based on the baseline scenario water use and the percent reduction in indoor water use achieved from a Project Applicant's commitment to installing low-flow and high-efficiency water fixtures. Table WUW-1.4 lists the estimated percent reductions in GHG emissions by water fixture and land use. The sum of all percent reductions applicable to the Project gives the overall percent reduction in GHG emissions expected from this mitigation measure. The details of these calculations are described below.

Measure Applicability:

- Indoor water use
- To meet CEQA enforcement requirements, the Project Applicant should only take credit for this mitigation measure if the clothes washers and dishwashers are supplied by the Project Applicant/builder.

Inputs:

The following information needs to be provided by the Project Applicant:

- Total expected indoor water demand, without installation of low-flow or high-efficiency fixtures (million gallons), AND
- Total expected indoor water demand, after installation of low-flow or high-efficiency fixtures (million gallons), OR
- Commitment to low-flow or high-efficiency water fixtures (toilets, showerheads, sink faucets, dishwashers, clothes washers, or all of the above)

Baseline Method:

$$\text{GHG emissions} = \text{Water}_{\text{baseline}} \times \text{Electricity} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$\text{Water}_{\text{baseline}}$ = Total expected indoor water demand, without installation of low-flow and high-efficiency fixtures (million gallons)

Provided by Applicant

Electricity = Electricity required to supply, treat, and distribute water and the resulting wastewater (kWh/million gallons)

Northern California Average: 5,411 kWh/million gallons

Southern California Average: 13,022 kWh/million gallons

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

Since this mitigation method does not change the electricity intensity factor (kWh/million gallons) associated with the supply, treatment, and distribution of the water, the percent reduction in GHG emissions is dependent only on the change in water consumption.

The Project Applicant can choose to compute the percent reduction in GHG emissions in one of three ways:

Method A

The Project Applicant can use Table WUW-1.4 to calculate the overall percent reduction in GHG emissions from committing to installing certain low-flow or high-efficiency water fixtures. The Project Applicant may commit to installing fixtures based on three standards: the California Green Building Standards Code (CGBSC) mandatory requirements, the CGBSC voluntary standards, or the ENERGY STAR standards. Table WUW-1.4 presents the percent reductions in GHG emissions for each of these three standards based on water fixture type (toilet, showerhead, clothes washer, etc) and land use type (residential, office, restaurant, etc). Note that in Table WUW-1.4, it is assumed that a Project Applicant commits to installing low-flow or high-efficiency fixtures for 100% of an end-use category (i.e. either 0% or 100% of toilets will be low-flow, either 0% or 100% of clothes washers will be high-efficiency, etc). The total percent reduction in GHG emissions expected from this mitigation measure is then simply the sum of all of the individual percent reductions:

$$\text{GHG emission reduction} = \sum \text{PercentReduction}_{\text{Fixture}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for indoor water use.

$\text{PercentReduction}_{\text{Fixture}}$ = Percent reduction in GHG emissions from each individual water fixture (i.e. toilet, bathroom faucet, dishwasher, etc.)
Provided in Table WUW-1.4

Method B

If the Project Applicant can provide detailed and substantial evidence to support a calculation of $\text{Water}_{\text{mitigated}}$, then that value can be used to calculate the percent GHG emission reduction using the following equation:

$$\text{GHG emission reduction} = \frac{\text{Water}_{\text{baseline}} - \text{Water}_{\text{mitigated}}}{\text{Water}_{\text{baseline}}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for indoor water use.

$\text{Water}_{\text{baseline}}$ = Total expected indoor water demand, without installation of low-flow and high-efficiency fixtures (million gallons)
Provided by Applicant

$\text{Water}_{\text{mitigated}}$ = Total calculated indoor water demand, after installation of low-flow and high-efficiency fixtures (million gallons)
Provided by Applicant or calculated using equations below

As shown in this equation, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Method C

The Project Applicant may choose to install fixtures which exceed the requirements of the California Green Building Standards Code but have different flow rates than those specified in the Tables WUW-1.1 and WUW-1.3. To take credit for this mitigation measure, the Project Applicant would need to calculate the percent reduction in GHG emissions using the equations below. In these equations, it is assumed that a Project Applicant commits to installing low-flow or high-efficiency fixtures for 100% of an end-use category (i.e. either 0% or 100% of toilets will be low-flow, either 0% or 100% of clothes washers will be high-efficiency, etc). More complicated equations are necessary to account for less than 100% commitment in one or more end-use categories.

$$Water_{mitigated} = \sum EndUseWater_{mitigated}$$

End-Uses are toilets, urinals, showerheads, bathroom faucets, kitchen faucets, dishwashers, clothes washers, and leaks and other.

Where,

$$EndUseWater_{mitigated} = EndUse_{PercentIndoor} \times Water_{baseline} \times \frac{EndUseFlowRate_{mitigated}}{EndUseFlowRate_{unmitigated}}$$

$EndUse_{PercentIndoor}$ = % of Indoor Water Use for that end-use
Provided in Table WUW-1.1 for Residential Buildings
Provided in Table WUW-1.1 for Non-Residential Buildings

$Water_{baseline}$ = Total expected indoor water demand, without installation of low-flow and high-efficiency fixtures (million gallons)
Provided by Applicant

$EndUseFlowRate_{baseline}$ = Baseline current California standard water flow rate for that end-use
Provided in Table WUW-1.1 for Residential Buildings
Provided in Table WUW-1.3 for Non-Residential Buildings

$EndUseFlowRate_{mitigated}$ = Mitigated water flow rate for that end use
Provided by Applicant, supported by manufacturer specification or technical sheets

For the Leak, Other end use and all end-uses where the Project Applicant makes no commitment to installing low-flow or high-efficiency water fixtures, $EndUseFlowRate_{mitigated} = EndUseFlowRate_{unmitigated}$, so then $EndUseWater_{mitigated} = EndUse_{PercentIndoor} \times Water_{baseline}$.

Then the percent reduction in GHG emissions is calculated as follows:

$$\text{GHG emission reduction} = \frac{Water_{baseline} - Water_{mitigated}}{Water_{baseline}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for indoor water use.

$Water_{baseline}$ = Total expected indoor water demand, without installation of low-flow and high-efficiency fixtures (million gallons)
Provided by Applicant

$Water_{mitigated}$ = Total calculated indoor water demand, after installation of low-flow and high-efficiency fixtures (million gallons)
Calculated by Applicant using equation above

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Estimated 20% reduction for residential buildings, assuming the Project Applicant commits to installing 100% of fixtures with the lowest flow rates presented in Table WUW-1.1. Estimated 17-31% reduction for non-residential buildings, assuming the Project Applicant commits to installing 100% of fixtures with the lowest flow rates presented in Table WUW-1.3.
All other pollutants	Not Quantified[87]

Discussion:

In this example, assume that a Project Applicant commits to installing the following:

For residences:

- 2010 CGBSC Mandatory Requirements for toilet, showerhead, bathroom faucet, and kitchen faucet
- ENERGY STAR residential standard dishwasher

For hotel:

- 2010 CGBSC Voluntary Standards for toilet, urinal, showerhead, bathroom faucet, and kitchen faucet
- ENERGY STAR top-loading clothes washer
- ENERGY STAR commercial dishwasher (high temp, under counter)

Using Method A, the following equation is employed:

$$\text{GHG emission reduction} = \sum PercentReduction_{Fixture}$$

[87] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

From Table WUW-1.4, the percent reduction in GHG emissions associated with indoor water use is then:

For residences:

$$6.6\% + 4.4\% + 5.7\% + 3.3\% + 0.2\% = 20.2\%$$

For hotel:

$$13.8\% + 5.4\% + 1.2\% + 0.8\% + 1.9\% + 6.4\% + 1.5\% = 31.0\%$$

Assumptions:

Data based upon the following references:

[1] CCR Title 24, Part 11. 2010. Draft California Green Building Standards Code. Available online at: http://www.documents.dgs.ca.gov/bsc/documents/2010/Draft-2010-CALGreenCode.pdf
[2] CCR Title 20, Division 2, Chapter 4, Article 4, Section 1605. Appliance Efficiency Regulations.
[3] Gleick, P.H.; Haasz, D.; Henges-Jeck, C.; Srinivasan, V.; Cushing, K.K.; Mann, A. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California. Published by the Pacific Institute for Studies in Development, Environment, and Security. Full report available online at: http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf. Appendices available online at: http://www.pacinst.org/reports/urban_usage/appendices.htm
[4] Mayer, P.W.; DeOreo, W.B.; Opitz, E.M.; Kiefer, J.C.; Davis, W.Y.; Dziegielewski, B.; Nelson, J.O. 1999. Residential End Uses of Water. Published by the American Water Works Association Research Foundation.
[5] USEPA. ENERGY STAR: Clothes Washers Key Product Criteria. Available online at: http://www.energystar.gov/index.cfm?c=clotheswash.pr_crit_clothes_washers
[6] USEPA. ENERGY STAR: Commercial Clothes Washers for Consumers. Available online at: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CCW
[7] USEPA. ENERGY STAR: Dishwashers Key Product Criteria. Available online at: http://www.energystar.gov/index.cfm?c=dishwash.pr_crit_dishwashers
[8] USEPA. ENERGY STAR Commercial Dishwashers Savings Calculator. Available online at: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=COH

Preferred Literature:

For the baseline scenario, the California Green Building Standards Code [1] specifies baseline water flow rates for toilets, showerheads, urinals, bathroom faucets, and kitchen faucets. The California Appliance Efficiency Regulation (Title 20) [2] specifies baseline water flow rates for residential and commercial dishwashers and clothes washers. For the mitigated scenario, the 2010 CGBSC also specifies water flow rates for toilets, showerheads, urinals, bathroom faucets, and kitchen faucets which become mandatory in 2011, additional voluntary flow rates for these same fixtures, and voluntary flow rates for commercial dishwashers and clothes washers. In addition, ENERGY STAR-certified residential and commercial dishwashers and clothes washers have mitigated water flow rates [5-8].

Alternative Literature:

None

Other Literature Reviewed:

[9] USEPA. Water Sense: Product Factsheets and Final Specifications. Available online at: http://www.epa.gov/watersense/products/index.html. Accessed February 2010.

USEPA WaterSense labeled products include toilets, bathroom sink faucets, and flushing urinals, and are certified to meet USEPA's standards for improved water efficiency. While WaterSense models do perform with greater water efficiency than federal standard models, they are not more efficient than the models required in California starting in 2011 due to the 2010 CGBSC. Furthermore, WaterSense models are compared to federal standard models and calculations would need to be adjusted to account for differences in California standards. USEPA reports that toilets, bathroom faucets, and showers account for 30%, 15%, and 17% of indoor household water use, respectively. USEPA reports that WaterSense toilets use 20% less water than the federal standard model, while WaterSense bathroom faucets use 30% less water. Federal standard showerheads use 2.5 gallons of water per minute while the WaterSense models use 2.0 gallons of water per minute, which is equivalent to the 2010 CGBSC Mandatory Requirement. Further, federal standard flushing urinal models use 1.0 gallons per flush, while WaterSense models uses 0.5 gallons per flush, which is equivalent to the 2010 CGBSC Mandatory Requirement.

Table WUW-1.1
Reduction in Water use from Low-flow or High-efficiency Residential Water Fixtures

Fixture	% of Indoor Water Use[1]	Water Flow Rate				
		Baseline Current California Standard[2]	Mitigated 2010 California Green Building Standards Code (Mandatory in 2011)[3]	Mitigated 2010 California Green Building Standards Code (Voluntary)[4]	Mitigated ENERGY STAR[5]	Unit
Toilet	33%	1.6	1.28	--	--	gallons/flush
Showerhead	22%	2.5	2.0	--	--	gallons/minute @ 60 psi
Bathroom Faucet	18%	2.2	1.5	--	--	gallons/minute @ 60 psi
Kitchen Faucet		2.2	1.8	--	--	gallons/minute @ 60 psi
Standard Dishwasher	1%	6.5	--	5.8	5.0	gallons/cycle
Compact Dishwasher		4.5	--	--	3.5	gallons/cycle
Top-loading Clothes Washer	14%	6.0	--	--	6.0	gallons/cycle/ cubic foot
Front-loading Clothes Washer		6.0	--	--	6.0	gallons/cycle/ cubic foot
Leaks, Other	12%	--	--	--	--	--

Notes:

1. Indoor household end use of water 2000 estimates from Figure 2-4c of the Pacific Institute report.
2. Baseline water flow rates for toilets, showerheads, bathroom faucets, and kitchen faucets are from the 2010 California Green Building Standards Code. Baseline water flow rates for dishwashers and clothes washers are from CCR Title 20, Division 2, Chapter 4, Article 4, Section 1605.2 (Appliance Efficiency Regulations for appliances sold in California).
3. Mitigated water flow rates for toilets, showerheads, bathroom faucets, and kitchen faucets are voluntary in 2010 and mandatory starting January 1, 2011.
4. Mitigated water flow rates for dishwashers and clothes washers are voluntary.
5. In some cases, the 2011 ENERGY STAR dishwasher and clothes washer models have lower flow rates than the 2010 California Green Building Standards Code. Using these ENERGY STAR models results in an additional mitigation beyond what is recommended by the 2010 California Green Building Standards Code.

Table WUW-1.2
Percent Indoor Water Use by End-Use in Non-Residential Buildings

End-Use	OFFICE		HOTEL		RESTAURANT		GROCERY STORE		NON-GROCERY RETAIL STORES		K-12 SCHOOL		OTHER SCHOOL	
	Total[1]	Indoor[2]	Total[1]	Indoor[2]	Total[1]	Indoor[2]	Total[1]	Indoor[2]	Total[1]	Indoor[2]	Total[1]	Indoor[2]	Total[1]	Indoor[2]
Restroom	26%	--	51%	--	34%	--	17%	--	26%	--	20%	--	20%	--
Toilets (72% of Restroom)	--	48%	--	46%	--	27%	--	26%	--	46%	--	51%	--	37%
Urinals (17% of Restroom)	--	11%	--	11%	--	6%	--	6%	--	11%	--	12%	--	9%
Faucets (4% of Restroom)	--	3%	--	3%	--	1%	--	1%	--	3%	--	3%	--	2%
Showers (7% of Restroom)	--	5%	--	4%	--	3%	--	2%	--	4%	--	5%	--	4%
Kitchen	3%	--	10%	--	46%	--	9%	--	4%	--	2%	--	1%	--
Faucets (57% of Kitchen)	--	4%	--	7%	--	29%	--	11%	--	6%	--	4%	--	1%
Dishwashers (24% of Kitchen)	--	2%	--	3%	--	12%	--	5%	--	2%	--	2%	--	1%
Ice Making (19% of Kitchen)	--	1%	--	2%	--	10%	--	4%	--	2%	--	1%	--	0%
Laundry	0%	0%	14%	18%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%
Other	10%	26%	5%	6%	12%	13%	22%	46%	11%	27%	6%	21%	17%	44%
Landscaping	38%	--	10%	--	6%	--	3%	--	38%	--	72%	--	61%	--
Cooling	23%	--	10%	--	2%	--	49%	--	21%	--	unknown	--	unknown	--
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Notes:
1. Water end-use data from Figures E-1, E-2, E-5, E-6, E-7, E-8, and E-9 of Appendix E of the Pacific Institute report.
2. Indoor end-use data calculated based on the total water use data for the relevant building category and Figure 4-3 and Figure 4-4 of the Pacific Institute report. Figure 4-3 shows the breakdown of restroom water use by end-use in the commercial & industry sector. Figure 4-4 shows the breakdown of kitchen water use by end-use in the commercial & industry sector; it was assumed that all end-uses except dishwashing and ice making are associated with faucet water use.

Table WUW-1.3
Reduction in Water use from Low-flow or High-efficiency Non-Residential Water Fixtures

Fixture	Water Flow Rate				
	Baseline Current California Standard[1]	Mitigated 2010 California Green Building Standards Code (Mandatory in 2011)[2]	Mitigated 2010 California Green Building Standards Code (Voluntary)[3]	Mitigated ENERGY STAR[4]	Unit
Toilet	1.6	1.28	1.12	--	gallons/flush
Urinal	1.0	0.5	0.5	--	gallons/flush
Showerhead	2.5	2.0	1.8	--	gallons/minute @ 60 psi
Bathroom Faucet	0.5	0.4	0.35	--	gallons/minute @ 60 psi
Kitchen Faucet	2.2	1.8	1.6	--	gallons/minute @ 60 psi
Dishwasher: High Temp, Under Counter	1.98	--	0.90	1.00	gallons/rack
Dishwasher: High Temp, Door	1.44	--	0.95	0.95	gallons/rack
Dishwasher: High Temp, Single Tank Conveyor	1.13	--	0.70	0.70	gallons/rack
Dishwasher: High Temp, Multi Tank Conveyor	1.10	--	0.70	0.54	gallons/rack
Dishwasher: Low Temp, Under Counter	1.95	--	0.98	1.70	gallons/rack
Dishwasher: Low Temp, Door	1.85	--	1.16	1.18	gallons/rack
Dishwasher: Low Temp, Single Tank Conveyor	1.23	--	0.62	0.79	gallons/rack
Dishwasher: Low Temp, Multi Tank Conveyor	0.99	--	0.62	0.54	gallons/rack
Top-loading Clothes Washer	9.5	--	8.6	6.0	gallons/cycle/ cubic foot
Front-loading Clothes Washer	9.5	--	8.6	6.0	gallons/cycle/ cubic foot

Notes:

1. Baseline water flow rates for toilets, showerheads, bathroom faucets, and kitchen faucets are from the 2010 California Green Building Standards Code. Baseline water flow rates for dishwashers are from the ENERGY STAR Commercial Dishwasher Calculator. Baseline water flow rates for clothes washers are from CCR Title 20, Division 2, Chapter 4, Article 4, Section 1605.2 (Appliance Efficiency Regulations for appliances sold in California).

2. These mitigated water flow rates for toilets, showerheads, bathroom faucets, and kitchen faucets are voluntary in 2010 and mandatory starting January 1, 2011.

3. These mitigated water flow rates for toilets, showerheads, bathroom faucets, and kitchen faucets are voluntary and represent the maximum recommended flow rate in order to achieve an overall 30% reduction in water use. Mitigated water flow rates for dishwashers and clothes washers are also voluntary. The range of values shown here represents different types of commercial dishwashers (high-temperature or chemical; conveyor, door, or undercounter models). See Appendix A5 of the 2010 California Green Building Standards Code for details.

4. In some cases, the ENERGY STAR dishwasher and clothes washer models have lower flow rates than the 2010 California Green Building Standards Code. Using these ENERGY STAR models results in an additional mitigation beyond what is recommended by the 2010 California Green Building Standards Code. See the following ENERGY STAR website for details: http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers

Table WUW-1.4

Percent Reductions in GHG emissions from Installing Low-Flow or High-Efficiency Water Fixtures

FIXTURE	LAND USE							
	RESIDENTIAL	OFFICE	HOTEL	RESTAURANT	GROCERY STORE	NON-GROCERY RETAIL STORE	K-12 SCHOOL	OTHER SCHOOL
2010 California Green Building Standards Code (Mandatory Requirements starting in 2011):								
Toilet	6.6%	9.6%	9.2%	5.3%	5.1%	9.1%	10.3%	7.4%
Urinal	N/A	5.7%	5.4%	3.1%	3.0%	5.4%	6.1%	4.4%
Showerhead	4.4%	0.9%	0.9%	0.5%	0.5%	0.9%	1.0%	0.7%
Bathroom Faucet	5.7%	0.5%	0.5%	0.3%	0.3%	0.5%	0.6%	0.4%
Kitchen Faucet	3.3%	0.8%	1.3%	5.2%	1.9%	1.0%	0.7%	0.3%
2010 California Green Building Standards Code (Voluntary Standards):								
Toilet	N/A	14.4%	13.8%	8.0%	7.7%	13.7%	15.4%	11.1%
Urinal	N/A	5.7%	5.4%	3.1%	3.0%	5.4%	6.1%	4.4%
Showerhead	N/A	1.3%	1.2%	0.7%	0.7%	1.2%	1.4%	1.0%
Bathroom Faucet	N/A	0.8%	0.8%	0.4%	0.4%	0.8%	0.9%	0.6%
Kitchen Faucet	N/A	1.2%	1.9%	7.8%	2.9%	1.5%	1.1%	0.4%
Top-Loading Clothes Washer	N/A	N/A	1.8%	N/A	N/A	N/A	N/A	0.3%

FIXTURE	LAND USE							
	RESIDENTIAL	OFFICE	HOTEL	RESTAURANT	GROCERY STORE	NON-GROCERY RETAIL STORE	K-12 SCHOOL	OTHER SCHOOL
Front-Loading Clothes Washer	N/A	N/A	1.8%	N/A	N/A	N/A	N/A	0.3%
Residential Standard Dishwasher	0.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Residential Compact Dishwasher	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Commercial Dishwasher: High Temp, Under Counter	N/A	1.0%	1.6%	6.5%	2.5%	1.3%	0.9%	0.3%
Commercial Dishwasher: High Temp, Door	N/A	0.6%	1.0%	4.1%	1.5%	0.8%	0.6%	0.2%
Commercial Dishwasher: High Temp, Single Tank Conveyor	N/A	0.7%	1.1%	4.6%	1.7%	0.9%	0.7%	0.2%
Commercial Dishwasher: High Temp, Multi Tank Conveyor	N/A	0.7%	1.1%	4.4%	1.6%	0.9%	0.6%	0.2%
Commercial Dishwasher: Low Temp, Under Counter	N/A	0.9%	1.5%	6.0%	2.2%	1.2%	0.9%	0.3%
Commercial Dishwasher: Low Temp, Door	N/A	0.7%	1.1%	4.5%	1.7%	0.9%	0.6%	0.2%
Commercial Dishwasher: Low Temp, Single Tank Conveyor	N/A	0.9%	1.5%	6.0%	2.2%	1.2%	0.9%	0.3%

FIXTURE	LAND USE							
	RESIDENTIAL	OFFICE	HOTEL	RESTAURANT	GROCERY STORE	NON-GROCERY RETAIL STORE	K-12 SCHOOL	OTHER SCHOOL
Commercial Dishwasher: Low Temp, Multi Tank Conveyor	N/A	0.7%	1.1%	4.5%	1.7%	0.9%	0.6%	0.2%
ENERGY STAR Standards:								
Top-Loading Clothes Washer	N/A	N/A	6.4%	N/A	N/A	N/A	N/A	0.9%
Front-Loading Clothes Washer	N/A	N/A	6.4%	N/A	N/A	N/A	N/A	0.9%
Residential Standard Dishwasher	0.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Residential Compact Dishwasher	0.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Commercial Dishwasher: High Temp, Under Counter	N/A	0.9%	1.5%	5.9%	2.2%	1.2%	0.8%	0.3%
Commercial Dishwasher: High Temp, Door	N/A	0.6%	1.0%	4.1%	1.5%	0.8%	0.6%	0.2%
Commercial Dishwasher: High Temp, Single Tank Conveyor	N/A	0.7%	1.1%	4.6%	1.7%	0.9%	0.7%	0.2%
Commercial Dishwasher: High Temp, Multi Tank Conveyor	N/A	0.9%	1.5%	6.1%	2.3%	1.2%	0.9%	0.3%
Commercial Dishwasher: Low Temp, Under Counter	N/A	0.2%	0.4%	1.5%	0.6%	0.3%	0.2%	0.1%

FIXTURE	LAND USE							
	RESIDENTIAL	OFFICE	HOTEL	RESTAURANT	GROCERY STORE	NON-GROCERY RETAIL STORE	K-12 SCHOOL	OTHER SCHOOL
Commercial Dishwasher: Low Temp, Door	N/A	0.7%	1.1%	4.3%	1.6%	0.8%	0.6%	0.2%
Commercial Dishwasher: Low Temp, Single Tank Conveyor	N/A	0.7%	1.1%	4.3%	1.6%	0.8%	0.6%	0.2%
Commercial Dishwasher: Low Temp, Multi Tank Conveyor	N/A	0.8%	1.4%	5.5%	2.0%	1.1%	0.8%	0.3%

Notes:

N/A indicates that either (a) an improved standard does not exist, or (b) the percent of indoor water use for that fixture and land use is typically zero. For example, (a) the ENERGY STAR standard for residential clothes washers is the same as the baseline current California standard, and (b) no water is expected to be used for laundry (clothes washers) in the Office land use.

4.2.2 Adopt a Water Conservation Strategy

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. It is equal to the Percent Reduction in water commitment.

Measure Description:

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Reducing water use reduces energy demand and associated indirect GHG emissions.

This mitigation measure describes how to calculate GHG emissions reductions from a Water Conservation Strategy which achieves X% reduction in water use (where X% is the specific percentage reduction in water use committed to by the Project Applicant). The steps taken to achieve this X% reduction in water use can vary in nature and may incorporate technologies which have not yet been established at the time this document was written. In order to take credit for this mitigation measure, the Project Applicant would need to provide detailed and substantial evidence supporting the percent reduction in water use.

The expected percent reduction is applied to the baseline water use, calculated according to the baseline methodology document. The energy-intensity factor associated with water conveyance, treatment, and distribution is provided in the 2006 CEC report [1].

This measure may incorporate other mitigation measures (WUW-1 through 6) of this document. As such, if this measure is used, the other measures cannot be used. These measures can be consulted to assist in determining methods of quantification and typical ranges of effectiveness.

Measure Applicability:

- Indoor and/or Outdoor water use

Inputs:

The following information needs to be provided by the Project Applicant:

- Total expected water demand, without implementation of Water Conservation Strategy (million gallons)
- Percent reduction in water use after implementation of Water Conservation Strategy (%)

Baseline Method:

$$\text{GHG emissions} = \text{Water}_{\text{baseline}} \times \text{Electricity} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$Water_{baseline}$ = Total expected water demand, without implementation of Water Conservation Strategy (million gallons)

Provided by Applicant

Electricity = Electricity required to supply, treat, and distribute water (and for indoor uses, the electricity required to treat the wastewater) (kWh/million gallons)

Northern California Avg (outdoor uses): 3,500 kWh/million gallons [1]

Northern California Avg (indoor uses): 5,411 kWh/million gallons [1]

Southern California Avg (outdoor uses): 11,111 kWh/million gallons [1]

Southern California Avg (indoor uses): 13,022 kWh/million gallons [1]

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

If there are percent reductions associated with both indoor and outdoor water use, the GHG emissions from indoor and outdoor water use should be calculated separately and then summed. Thus,

$$\text{Total GHG emissions} = \text{GHG emissions}_{indoor} + \text{GHG emissions}_{outdoor}$$

Mitigation Method:

Since this mitigation method does not change the electricity intensity factor (kWh/million gallons) associated with the supply and distribution of the water, the percent reduction in GHG emissions is dependent only on the change in water consumption:

$$\text{GHG emission reduction} = \text{PercentReduction}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for water use.

PercentReduction = Expected percent reduction in water use after implementation of Water Conservation Strategy (%)

Provided by Applicant

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	To be determined by Applicant

All other pollutants	Not Quantified[88]

Discussion:

The percent reduction in GHG emissions is equivalent to the percent reduction in indoor and outdoor water usage. Therefore, if a Project Applicant implements a Water Conservation Strategy which achieves a 10% reduction in water use, the GHG emissions associated with water use are reduced by 10%.

Assumptions:

Data based upon the following reference:

[1] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

Preferred Literature:

2006 CEC report

Alternative Literature:

None

Other Literature Reviewed:

None

[88] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

4.2.3 Design Water-Efficient Landscapes

Range of Effectiveness: 0 – 70% reduction in GHG emissions from outdoor water use

Measure Description:

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Designing water-efficient landscapes for a project site reduces water consumption and the associated indirect GHG emissions. Examples of measures which a Project Applicant should consider when designing landscapes are reducing lawn sizes, planting vegetation with minimal water needs such as California native species, choosing vegetation appropriate for the climate of the project site, and choosing complimentary plants with similar water needs or which can provide each other with shade and/or water.

This measure describes how to calculate GHG savings from residential and commercial landscape plantings which have decreased watering demands compared to standard California landscape plantings. The methodology for calculating water demand presented here is based on the California Department of Water Resources (CDWR) 2009 Model Water Efficient Landscape Ordinance [1] and the CDWR 2000 report: "A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III" ("WUCOLS") [2].

By January 1, 2010, all local water agencies were required to adopt the CDWR Model Water Efficient Landscape Ordinance or develop their own local ordinance which is at least as effective at conserving water as the Model Ordinance. Some local agencies have published or are in the process of developing local ordinances.[89] A Project Applicant may choose to use the methodology presented in a local ordinance to demonstrate a percent reduction in water use and GHG emissions; however, the calculations will be similar to the methodology presented in the CDWR Model Ordinance and re-described here.

Measure Applicability:

- Outdoor water use

Inputs:

The following information needs to be provided by the Project Applicant:

---

[89] List of local water agencies and a description of their plans to either adopt the CDWR Model Ordinance or develop their own ordinance: ftp://ftp.water.ca.gov/Model-Water-Efficient-Landscape-Ordinance/Local-Ordinances/

- $Water_{baseline}$, to be calculated by the Project Applicant using the methodology described below
- $Water_{mitigated}$, to be calculated by the Project Applicant using the methodology described below

Baseline Method:

The Project's baseline water use is the Maximum Applied Water Allowance (MAWA) described in the Model Water Efficient Landscape Ordinance:

$$MAWA = ET_0 \times 0.62 \times [(0.7 \times LA) + (0.3 \times SLA)]$$

Where:

MAWA	=	Maximum Applied Water Allowance (gallons per year)
ET_0	=	Annual Reference Evapotranspiration[90] from Appendix A of the Model Water Efficient Landscape Ordinance (inches per year)
0.7	=	ET Adjustment Factor (ETAF)
LA	=	Landscape Area[91] includes Special Landscape Area[92] (square feet)
0.62	=	Conversion factor (to gallons per square foot)
SLA	=	Portion of the landscape area identified as Special Landscape Area (square feet)
0.3	=	the additional ET Adjustment Factor for Special Landscape Area

Then the baseline GHG emissions are calculated as follows:

$$GHG\ emissions = MAWA \times Electricity \times Utility$$

Where:

GHG emissions = MT CO_2e

Electricity = Electricity required to supply, treat, and distribute water (kWh/million gallons)
Northern California Average (outdoor uses): 3,500 kWh/million gallons
Southern California Average (outdoor uses): 11,111 kWh/million gallons

[90] Evapotranspiration is water lost to the atmosphere due to evaporation from soil and transpiration from plant leaves. For a more detailed definition, see this California Irrigation Management Information System (CIMIS) website: http://wwwcimis.water.ca.gov/cimis/infoEtoOverview.jsp;jsessionid=91682943559928B8A9A243D2A2665E19

[91] § 491 Definitions in Model Water Efficient Landscape Ordinance: "Landscape Area (LA) means all the planting areas, turf areas, and water features in a landscape design plan subject to the Maximum Applied Water Allowance calculation. The landscape area does not include footprints of buildings or structures, sidewalks, driveways, parking lots, decks, patios, gravel or stone walks, other pervious or non-pervious hardscapes, and other non-irrigated areas designed for non-development (e.g., open spaces and existing native vegetation)."

[92] § 491 Definitions in Model Water Efficient Landscape Ordinance: "Special Landscape Area (SLA) means an area of the landscape dedicated solely to edible plants, areas irrigated with recycled water, water features using recycled water and areas dedicated to active play such as parks, sports fields, golf courses, and where turf provides a playing surface."

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

Since this mitigation method does not change the electricity intensity factor (kWh/million gallons) associated with the supply, treatment, and distribution of the water, the percent reduction in GHG emissions is dependent only on the change in water consumption.

The Project's mitigated water use is the Estimated Total Water Use (ETWU) described in the Model Water Efficient Landscape Ordinance:

$$ETWU = ET0 \times 0.62 \times \left(\frac{PF \times HA}{IE} + SLA \right)$$

Where:

ETWU	=	Estimated total water use (gallons per year)
ET_0	=	Annual Reference Evapotranspiration from Appendix A of the Model Water Efficient Landscape Ordinance (inches per year)
PF	=	Plant Factor from WUCOLS[93] see Table WUW-3.1 for examples and WUCOLS for a complete list of values
HA	=	Hydrozone Area[94] (square feet)
SLA	=	Special Landscape Area (square feet)
0.62	=	Conversion factor (to gallons per square foot)
IE	=	Irrigation Efficiency[95] (minimum 0.71)

Then the percent reduction in GHG emissions is calculated as follows:

$$\text{GHG emission reduction} = \frac{MAWA - ETWU}{MAWA}$$

[93] § 491 Definitions in Model Water Efficient Landscape Ordinance: "Plant Factor (PF)" is a factor, when multiplied by ET_0, estimates the amount of water needed by plants." The Model Water Efficient Landscape Ordinance indicates that PF is 0-0.3 for low water use plants, 0.4-0.6 for moderate water use plants, and 0.7-1.0 for high water use plants. PF is equivalent to the "species factor" (k_s) in WUCOLS. See Table A above for examples of low, moderate, and high water use plants from WUCOLS. For a complete list of PF (k_s) values, see the species evaluation list in WUCOLS.

[94] § 491 Definitions in Model Water Efficient Landscape Ordinance: "Hydrozone means a portion of the landscaped area having plants with similar water needs. A hydrozone may be irrigated or non-irrigated."

[95] § 491 Definitions in Model Water Efficient Landscape Ordinance: "Irrigation Efficiency (IE) means the measurement of the amount of water beneficially used divided by the amount of water applied. Irrigation efficiency is derived from measurements and estimates of irrigation system characteristics and management practices. The minimum average irrigation efficiency for purposes of the ordinance is 0.71. Greater irrigation efficiency can be expected from well designed and maintained systems."

As shown in this equation, the regional electricity intensity factor and utility carbon intensity factor do not play a role in determining the percentage reduction in GHG emissions. Furthermore, since ET_0 is a multiplier in both MAWA and ETWU, it cancels out and therefore ET_0 does not play a role in determining the percentage reduction in GHG emissions either.

Table WUW-3.1: Example Plant Factor (PF) Values from WUCOLS

Water Needs	PF Range	Plant Type	Species Examples
Low	0 - 0.3	tree	Quercus agrifolia (coast live oak)
			Yucca
			Pinus halepensis (Aleppo pine)
		shrub	Quercus berberidifolia (California scrub oak)
			Lonicera subspicata (chaparral honeysuckle)
			Salvia apiana (white sage)
		vine	Macfadyena unguis-cati (cat's claw)
		groundcover	Arctostaphylos spp. (manzanita)
		perennial	Monardella villosa (coyote mint)
Moderate	0.4 - 0.6	tree	Acer negundo (California box elder)
			Acer paxii (evergreen maple)
		shrub	Buxus microphylla japonica (Japanese boxwood)
		vine	Wisteria
			Aristolochia durior (Dutchman's pipe)
		groundcover	Ceratostigma plumbaginoides (dwarf plumbago)
		perennial	Monarda didyma (bee balm)
	0.6	turf grasses (warm season)	Bermudagrass
			kikuyugrass
			seashore paspalum
			St. Augustinegrass
			zoysiagrass
High	0.7 - 1.0	tree	Betula pendula (European white birch)
			Betula nigra (river/red birch)
		shrub	Cyathea cooperii (Australian tree fern)
			Cornus stolonifera (red osier dogwood)
		groundcover	Soleirolia soleirolii (baby's tears)
		perennial	Mimulus spp., herbaceous (monkey flower)
			Woodwardia radicans (European chain fern)
			Acorus gramineus (sweet flag)
	0.8	turf grasses (cool season)	annual bluegrass
			annual ryegrass
			colonial bentgrass
			creeping bentgrass
			hard fescue
			highland bentgrass
			Kentucky bluegrass
			meadow fescue
			perennial ryegrass
			red fescue
			rough-stalked bluegrass
			tall fescue

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Assuming an irrigation efficiency of 71% as specified in the Model Water Efficient Landscape Ordinance and no Special Landscape Area: • 0% reduction if 100% of vegetation is Moderate PF • 13% reduction if 40% of vegetation is Low PF, 40% is Moderate PF, and 20% is High PF • 35% reduction if 50% of vegetation is Low PF and 50% is Moderate PF • 70% reduction if 100% of vegetation is Low PF
All other pollutants	Not Quantified[96]

Discussion:

Example calculations of MAWA and ETWU are provided in the Model Water Efficient Landscape Ordinance. In this example, assume that the Project Applicant has used the equations to calculate MAWA = 100 million gallons and ETWU = 80 million gallons. Then the GHG emissions reduction is 20%:

$$\text{GHG Emission Reduced} = \frac{100-80}{100} = 0.2 \text{ or } 20\%$$

Assumptions:

Data based upon the following references:

[1] California Department of Water Resources. 2009. Model Water Efficient Landscape Ordinance. Available online at: http://www.water.ca.gov/wateruseefficiency/docs/MWELO09-10-09.pdf

[2] ("WUCOLS"): California Department of Water Resources. 2000. A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III. Available online at: http://www.water.ca.gov/pubs/conservation/a_guide_to_estimating_irrigation_water_needs_of_landscape_plantings_in_california__wucols/wucols00.pdf

[3] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

Preferred Literature:

The California Department of Water Resources Model Water Efficient Landscape Ordinance requires that the Estimated Total Water Use (ETWU) of certain landscape

[96] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

projects shall not exceed the Maximum Applied Water Allowance (MAWA) for that landscape area. The MAWA is calculated based on average irrigation efficiencies and plant factors, two major influences on the water demand of a landscape. The ETWU is calculated based on project-specific plant factors and irrigation efficiency.

Alternative Literature:

[4] ("WUCOLS"): California Department of Water Resources. 2000. A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III. Available online at: http://www.water.ca.gov/pubs/conservation/a_guide_to_estimating_irrigation_water_needs_of_landscape_plantings_in_california__wucols/wucols00.pdf

[5] The Las Pilitas Nursery website has a user-friendly and searchable database of native California plants: http://www.laspilitas.com/shop/plant-products. As shown in WUCOLS, many California native plants have minimal or very low water needs.

The equation on page 9 of WUCOLS [4] shows that water demand for irrigation landscape plantings (ETL, landscape evapotranspiration) is calculated by multiplying two parameters: the landscape coefficient (KL) and the reference evapotranspiration (ETo). KL values are based on a species factor, density factor, and microclimate factor. The guidance provides detailed instructions on how to assign project-specific values for these three factors. KL can then be divided by the irrigation efficiency to obtain the Total Water Applied, as shown on page 31 of the guidance [4]. Total Water Applied is analogous to ETWU in the methodology shown above. Thus, the detailed WUCOLS methodology could be used to perform a more rigorous calculation of ETWU which incorporates microclimate effects (e.g. windy areas, areas shaded by buildings, etc) and vegetation density effects.

Other Literature Reviewed:

None

4.2.4 Use Water-Efficient Landscape Irrigation Systems

Range of Effectiveness: 6.1% reduction in GHG emissions from outdoor water

Measure Description:

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Using water-efficient landscape irrigation techniques such as "smart" irrigation technology reduces outdoor water demand, energy demand, and the associated GHG emissions.[97]

"Smart" irrigation control systems use weather, climate, and/or soil moisture data to automatically adjust watering schedules in response to environmental and climate changes, such as changes in temperature or precipitation levels. Thus, the appropriate amount of moisture for a certain vegetation type is maintained, and excessive watering is avoided. Many companies which design and install smart irrigation systems, such as Calsense, ET Water, and EPA-certified WaterSense Irrigation Partners, may be able to provide a site-specific estimate of the percent reduction in outdoor water use that can be expected from installing a smart irrigation system. Expected reductions are in the range of 1 – 30%, with the high end of the range associated with historically high water users. To take credit for the high end of the GHG emissions reductions based on these company quotes, the Project Applicant would need to provide detailed and substantial evidence supporting the proposed percent reduction in water use. Alternatively, the Project Applicant could apply the average percent reduction reported in a 2009 study conducted by Aquacraft, Inc. in cooperation with the California Department of Water Resources, the California Urban Water Conservation Council, and a consortium of California water utilities. This comprehensive study showed that smart irrigation systems of various brands achieve an average of 6.1% reduction in outdoor water use in California. This percent reduction is based on a two year study (one year pre and post installation of smart controllers) of over two thousand sites in seventeen different water utilities throughout northern and southern California. While the study also presents utility-specific percent reductions, variations in implementation and sample size between utilities renders these percent reductions insufficient for characterization in a mitigation measure at this time. The study also notes that for a sample of smart controllers where data was collected for three years after installation, the percent reduction in water use increased with time, with the greatest percent reduction achieved in year three.

[97] The installation of smart irrigation controllers will be required starting in 2011 as indicated in the 2010 Draft California Green Building Standards Code. As technology advances and newer generation smart irrigation controllers become available, the Project Applicant may choose to use this mitigation measure to quantify water use and associated GHG reductions beyond what would be achieved with the standards required by the California Green Building Standards Code.

The expected percent reduction is applied to the baseline water use, calculated according to the baseline methodology document. The energy-intensity factor associated with water conveyance and distribution is provided in the 2006 CEC report [2].

Measure Applicability:

- Outdoor water use

Inputs:

The following information needs to be provided by the Project Applicant:

- Total expected outdoor water demand, without installation of smart landscape irrigation controller (million gallons).
- (Optional) Project-specific percent reduction in outdoor water demand, after installation of smart landscape irrigation controller. Percent reduction must be verifiable. Otherwise, use the default value of 6.1%.

Baseline Method:

$$\text{GHG emissions} = \text{Water}_{\text{baseline}} \times \text{Electricity} \times \text{Utility}$$

Where:

GHG emissions = MT CO_2e

$\text{Water}_{\text{baseline}}$ = Total expected outdoor water demand, without installation of smart landscape irrigation controllers (million gallons)
Provided by Applicant

Electricity = Electricity required to supply, treat, and distribute water (kWh/million gallons)
Northern California Average: 3,500 kWh/million gallons
Southern California Average: 11,111 kWh/million gallons

Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

Since this mitigation method does not change the electricity intensity factor (kWh/million gallons) associated with the supply and distribution of the water, the percent reduction in GHG emissions is dependent only on the change in water consumption:

$$\text{GHG emission reduction} = \text{PercentReduction} \times \text{Water}_{\text{baseline}}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for outdoor water use.

$\text{Water}_{\text{baseline}}$ = Total expected outdoor water demand, without installation of smart landscape irrigation controllers (million gallons)

Provided by Applicant

PercentReduction = Expected percent reduction in water use after installation of smart landscape irrigation controllers (%)

Provided by Applicant or use default 6.1%

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	6.1% unless project-specific data is provided
All other pollutants	Not Quantified[98]

Discussion:

The percent reduction in GHG emissions is equivalent to the percent reduction in outdoor water usage. Therefore, if a Project Applicant uses the default percent reduction in water usage associated with installing smart landscape irrigation control systems (6.1%), the resulting reduction in GHG emissions is also 6.1%.

Assumptions:

Data based upon the following references:

[1] "Evaluation of California Weather-Based "Smart" Irrigation Controller Programs." July 2009. Presented to the California Department of Water Resources by The Metropolitan Water District of Southern California and The East Bay Municipal Utility District. Facilitated by the California Urban Water Conservation Council. Prepared by Aquacraft Inc., National Research Center Inc., and Dr. Peter J. Bickel. Available online at: http://www.aquacraft.com/Download_Reports/Evaluation_of_California_Smart_Controller_Programs_-_Final_Report.pdf

[2] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

Preferred Literature:

As described above, the 2009 study [1] conducted by Aquacraft, Inc. in cooperation with the California Department of Water Resources, the California Urban Water Conservation Council, and a consortium of California water utilities showed that smart

[98] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

irrigation systems of various brands achieve an average of 6.1% reduction in outdoor water use in California.

Alternative Literature:

When common watering systems such as in-ground sprinklers are used, much of the water applied to lawns and landscapes is not absorbed by the vegetation. Instead, it is lost through runoff or evaporation. The USEPA reports that a study by the American Water Works Association found that households with in-ground sprinkler systems used 35% more water outdoors than households without these systems, while households with drip irrigation systems used 16% more water [3]. The USEPA reports that hand-held hoses or sprinklers are often more water efficient than automatic irrigation systems.

However, “smart” automatic landscape irrigation systems do exist. Examples include systems which automatically adjust watering schedules in response to environmental and climate changes, such as changes in temperature or precipitation levels. A few references have quantified reductions from this type of irrigation strategy. The Southern Nevada Water Authority reports that smart irrigation systems can reduce outdoor water use by an average of 15 to 30 percent, depending on the system, landscape type, and location [4]. One study conducted in 40 households with historically high water use in Irvine, California showed an average reduction in outdoor water use of 16% [5,6]. Another study conducted in Santa Barbara, California households with historically high water use showed an average water savings of 26% [5,7]. A Project Applicant could also hire an EPA-certified WaterSense Irrigation Partner to design and install a new irrigation system or audit an existing system in an effort to minimize the amount of water consumed [6].

[3] USEPA. 2002. Water-Efficient Landscaping: Preventing Pollution & Using Resources Wisely. Available online at: http://www.epa.gov/npdes/pubs/waterefficiency.pdf
[4] Southern Nevada Water Authority. Smart Irrigation Controllers. Available online at: http://www.snwa.com/html/land_irrig_smartclocks.html. Accessed March 2010.
[5] Irrigation Association. Smart Controller Efficiency Testing. Available online at: http://www.irrigation.org/SWAT/Industry/case-studies.asp. Accessed March 2010.
[6] Irvine Ranch Water District, et al. 2001. Residential Weather-Based Irrigation Scheduling: Evidence from the Irvine “ET Controller” Study. Available online at: http://www.irrigation.org/swat/images/irvine.pdf
[7] Santa Barbara County Water Agency, et al. 2003. Santa Barbara County ET Controller Distribution and Installation Program Final Report. Available online at: http://www.irrigation.org/swat/images/santa_barbara.pdf
[8] USEPA. WaterSense: Landscape Irrigation. Available online at: http://www.epa.gov/WaterSense/services/landscape_irrigation.html

4.2.5 Reduce Turf in Landscapes and Lawns

Range of Effectiveness: Varies and is equal to the percent commitment to turf reduction, assuming no other outdoor water uses

Measure Description:

Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Turf grass (i.e. lawn grass) has relatively high water needs compared to most other types of vegetation. For example, trees planted in turf generally do not need additional watering besides what is required for the turf. Water agencies in Southern California have instituted turf removal programs which provide rebates for resident who reduce the turf area in their lawns. Reducing the turf size of landscapes and lawns reduces water consumption and the associated indirect GHG emissions.[99]

This measure describes how to calculate GHG savings from reducing the turf area of an existing lawn by X square feet, or designing a lawn to have X square feet less than the turf area of a standard lawn at the project location.[100]

Additional GHG emissions reductions may occur due to a reduction in fertilizer usage. Since this will vary based on individual occupant behavior, this reduction in GHG emissions from decreased fertilizer usage is not quantified.

Measure Applicability:

- Outdoor water use

Inputs:

The following information needs to be provided by the Project Applicant:

- Turf area of existing lawn or standard lawn at the project location (square feet)
- Turf area reduction commitment (square feet reduced or percent of baseline reduced)

Baseline Method:

[99] See the SoCal WaterSmart Residential Turf Program description at http://socalwatersmart.com/index.php?option=com_content&view=article&id=77&Itemid=10. Accessed March 2010.

[100] The Project Applicant would need to provide a value for and evidence supporting this “standard-sized lawn.” This value is likely to vary greatly depending on the type of building (single-family, condo, apartment complex, commercial space) as well as location (region in California, urban or suburban).

The methodology for calculating water demand presented here is based on the California Department of Water Resources (CDWR) 2009 Model Water Efficient Landscape Ordinance [1] and the CDWR 2000 report: "A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III" [2].

The Project Applicant should first calculate the amount of water required to support the existing turf or standard-sized turf ($Water_{baseline}$).[101] In the equations below, "crop" also represents "turf grass," or lawn grasses.

$$ET_C = K_c \times ET_0$$

Where:

ET_C = Crop Evapotranspiration, the total amount of water the baseline turf loses during a specific time period due to evapotranspiration[102] (inches water/day)

K_C = Crop Coefficient, factor determined from field research, which compares the amount of water lost by the crop (e.g. turf) to the amount of water lost by a reference crop (unitless)

Species-specific; provided in Table WUW-5.1 below

ET_0 = Reference Evapotransporation, the amount of water lost by a reference crop (inches water/day)

Region-specific; provided in Appendix A of the CDWR Model Water Efficient Landscape Ordinance [1]

[101] Page 10 of the CDWR report explains that the objective of landscape management is to maintain the "health, appearance, and reasonable growth" of plants, and not necessarily to replenish all of the water lost at maximum evapotranspiration rates. Thus, the CDWR methodology presented here calculates only the amount of water required to sustain the health, appearance, and growth of the plants.

[102] Evapotranspiration is water lost to the atmosphere due to evaporation from soil and transpiration from plant leaves. For a more detailed definition, see this California Irrigation Management Information System (CIMIS) website: http://wwwcimis.water.ca.gov/cimis/infoEtoOverview.jsp;jsessionid=91682943559928B8A9A243D2A2665E19

**Table WUW-5.1:
Crop Coefficient for Turf Grasses**

Category	Kc	Species
cool season grasses	0.8	annual bluegrass annual ryegrass colonial bentgrass creeping bentgrass hard fescue highland bentgrass Kentucky bluegrass meadow fescue perennial ryegrass red fescue rough-stalked bluegrass tall fescue
warm season grasses	0.6	Bermudagrass kikuyugrass seashore paspalum St. Augustinegrass zoysiagrass

Reference: p. 6 and p. 137 of CDWS report

Then: $$Water_{baseline} = ETC \times Area_{baseline} \times 0.62 \times 365$$

Where:

$Water_{baseline}$ = Volume of water required to support the baseline turf (gallons/year)
$Area_{baseline}$ = Area of existing or standard turf (square feet)
Provided by the Applicant
0.62 = conversion factor (gallons/squarefoot·inches water)
365 = conversion factor (days/year)
ETC = Crop evapotranspiration
Calculated using the equation on page 280

Then the baseline GHG emissions are calculated as follows:

$$\text{GHG emissions} = Water_{baseline} \times Electricity \times Utility$$

Where:

GHG emissions = MT CO_2e
Electricity = Electricity required to supply, treat, and distribute water (kWh/million gallons)

Northern California Average (outdoor uses): 3,500 kWh/million gallons
Southern California Average (outdoor uses): 11,111 kWh/million gallons
Utility = Carbon intensity of Local Utility (CO_2e/kWh)

Mitigation Method:

The equations above show that the GHG emissions are directly proportional to the water demand, which is in turn directly proportional to the area of the turf. Therefore, only the area of the existing or standard turf and the commitment to turf area reduction (square feet reduced or percent of baseline reduced) are needed to calculate the percent reduction in GHG emissions:

$$\text{GHG emission reduction} = \frac{\text{Area}_{\text{reduction}}}{\text{Area}_{\text{baseline}}} = \text{AreaPercentReduction}$$

Where:

$\text{Area}_{\text{reduction}}$ = Area of turf to be reduced (square feet)
Provided by the Applicant
$\text{Area}_{\text{baseline}}$ = Area of existing or standard turf (square feet)
Provided by the Applicant
AreaPercentReduction = Percent reduction in turf area (%)
Provided by the Applicant

As shown in this equation, the regional electricity intensity factor for water and the utility carbon intensity factor do not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Up to 100%, assuming 100% reduction in turf grass area. This would be the case for rock-lawns, for example.
All other pollutants	Not Quantified[103]

Discussion:

In this example, assume that the Project Applicant has provided detailed evidence to show that the turf area of a standard lawn at the project location is 8,000 square feet. If the Project Applicant then commits to reducing the turf area of lawns by 3,000 square feet, then the GHG emissions reduction is 37.5%.

[103] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

$$\text{GHG Emission Reduced} = \frac{3{,}000}{8{,}000} = 0.375 \text{ or } 37.5\%$$

Assumptions:

Data based upon the following references:

[1] California Department of Water Resources. 2009. Model Water Efficient Landscape Ordinance. Available online at: http://www.water.ca.gov/wateruseefficiency/docs/MWELO09-10-09.pdf

[2] California Department of Water Resources. 2000. A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III. Available online at: http://www.water.ca.gov/pubs/conservation/a_guide_to_estimating_irrigation_water_needs_of_landscape_plantings_in_california__wucols/wucols00.pdf

[3] CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. Available online at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

Preferred Literature:

See above

Alternative Literature:

None

Other Literature Reviewed:

None

4.2.6 Plant Native or Drought-Resistant Trees and Vegetation

Range of Effectiveness: Best Management Practice; may be quantified if substantial evidence is available.

Measure Description:

California native plants within their natural climate zone and ecotype need minimal watering beyond normal rainfall, so less water is needed for irrigating native plants than non-native species. Drought-resistant vegetation needs even less watering. Water use contributes to GHG emissions indirectly, via the production of the electricity that is used to pump, treat, and distribute the water. Thus, planting native and drought-resistant vegetation reduces water use and the associated GHGs. Designing landscapes with native plants can provide many other benefits, including reducing the need for fertilization and pesticide use, and providing a more natural habitat for native wildlife. Although there is much anecdotal evidence for the benefits of planting native vegetation, few scientific studies have quantified the actual water savings. Therefore, this mitigation measure would most likely be employed as a Best Management Practice. Future studies may quantify the water-saving benefits of planting native or drought-resistant vegetation. In order to take quantitative credit for this mitigation measure, the Project Applicant would need to provide detailed and substantial evidence supporting a percent reduction in water use. The percent reduction would be applied to the baseline water use, calculated according to the baseline methodology described in WUW-3 (Design water efficient landscapes) and the baseline methodology document.

Measure Applicability:

- Outdoor water use

Inputs:

The following information needs to be provided by the Project Applicant:

- Percent reduction in water use, calculated using detailed and substantial evidence
- $Water_{baseline}$, to be calculated by the Project Applicant using the baseline methodology described in WUW-3 (Design water efficient landscapes) and the baseline methodology document

Baseline Method

See WUW-3 (Design water efficient landscapes)

Mitigation Method

Since this mitigation method does not change the electricity intensity factor (kWh/million gallons) associated with the supply, treatment, and distribution of the water, the percent reduction in GHG emissions is dependent only on the change in water consumption:

$$\text{GHG emission reduction} = \text{PercentReduction} \times \text{Water}_{baseline}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions for outdoor water use.

$\text{Water}_{baseline}$ = Baseline water demand, without planting native or drought-resistant vegetation

Provided by Applicant, calculated using baseline methodology of Mitigation Measure WUW-3

PercentReduction = Expected percent reduction in water use resulting from planting native or drought-resistant vegetation

Provided by Applicant

As shown in these equations, the carbon intensity of the local utility does not play a role in determining the percentage reduction in GHG emissions.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	To be determined by Applicant
All other pollutants	Not Quantified[104]

Discussion:

Currently there is not sufficient substantial evidence supporting a generalized reduction in emissions due to planting native or drought tolerant species. However, if the project applicant is able to provide sufficient substantial evidence supporting a reduction in water usage associated with native or drought tolerant species, the percent reduction in GHG emissions is equivalent to the percent reduction in outdoor water usage. Therefore, if a Project Applicant can support a 10% reduction in water use by native and drought tolerant species, the GHG emissions associated with water use are reduced by 10%.

Assumptions:

None

[104] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

Alternative Literature:

The EPA reports that while there is anecdotal evidence for the water-saving benefits of planting native and drought-resistant vegetation, there are very few scientific studies available which quantify the benefits. There are several good resources available which describe the qualitative benefits. The California Native Plant Society provides many resources for designing a native plant garden, including how to identify native plants and where to buy them. The Las Pilitas Nursery provides similar resources and also lists species of drought-resistant plants that are best for specific California regions. The EPA also provides tips for designing landscapes with native plants.

USEPA. "Exploring the Environmental, Social and Economic Benefits Conference," December 6-7, 2004. USEPA. Greenacres: Landscaping with Native Plants Research Needs. Available online at: http://www.epa.gov/greenacres/conf12_04/conf_A.html. Accessed March 2010.
California Native Plant Society. Homepage. Available online at: http://www.cnps.org/. Accessed March 2010.
Las Pilitas Nursery. Drought Tolerant or Resistant Native Plants. Available online at: http://www.laspilitas.com/garden/Drought_resistant_plants_for_a_California_garden.html. Accessed March 2010.
USEPA. Greenacres: Native Plants Brochure. Available online at: http://www.epa.gov/greenacres/navland.html#Introduction. Accessed March 2010.

Alternative Literature:

None.

Other Literature Reviewed:

None

5.0 Landscaping Equipment

5.1 Landscaping Equipment

5.1.1 Prohibit Gas Powered Landscape Equipment.

Measure Description:

Electric lawn equipment including lawn mowers, leaf blowers and vacuums, shredders, trimmers, and chain saws are available. When electric landscape equipment is used in place of a conventional gas-powered equipment, direct GHG emissions from natural gas combustion are replaced with indirect GHG emissions associated with the electricity used to power the equipment.

Measure Applicability:

[1] Landscaping equipment

Inputs:

The following information needs to be provided by the Project Applicant:

- Electricity provider for the Project
- Horsepower of landscaping equipment
- Hours of operation

Baseline Method:

Look up landscape equipment emission factor based on type of fuel used:

Landscaping Equipment Horsepower	CO_2 Emission Factor from Gasoline (g/hp-hr)
< 25	429.44
25 – 50	783.30
50 – 120	774.50
120 –175	753.25
> 175	732.00

$$\text{GHG emission} = EF \times Hp \times LF \times Hr \times 10^{-6}$$

Where:

GHG emission = MT CO_2e per year

EF = CO_2 emission factor for the relevant horsepower tier show in table above (g/hp-hr). Obtained from OFFROAD2007.

Hp = Horsepower of landscaping equipment
LF = Load factor of equipment for the relevant horsepower tier (dimensionless). Obtained from OFFROAD2007.
Hr = Hours of operation per year
10^{-6} = Unit conversion from grams to MT

Mitigation Method:

Landscaping equipment will run on electricity instead of gasoline. The indirect GHG emission from electricity generation is:

$$\text{GHG emission} = \text{Utility} \times \text{Hp} \times \text{LF} \times \text{Hr} \times \text{C}$$

Where:
GHG emissions = MT CO_2e
Utility = Carbon intensity of Local Utility (CO_2e/kWh). See table below.
Hp = Horsepower of landscaping equipment.
LF = Load factor of equipment for the relevant horsepower tier (dimensionless). Obtained from OFFROAD2007.
Hr = Hours of operation.
C = Unit conversion factor

Power Utility	Carbon-Intensity (lb CO_2e/kWh)
LADWP	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

$$\text{GHG Reduction \%}^{105} = 1 - \frac{\text{Utility} \times \text{C}}{\text{EF} \times 10^{-6}}$$

EF = Emission Factor for the relevant fuel horsepower tier (g/hp-hr) Obtained from OFFROAD2007. See accompanying tables.

Emission Reduction Ranges and Variables:

Power Utility	Equipment Horsepower	Project GHG Emission Reductions
LADWP	< 25	2.5%
	25 – 50	46.5%

105 This assumes energy from engine losses are the same.

Power Utility	Equipment Horsepower	Project GHG Emission Reductions
	50 – 120	45.9%
	120 –175	44.4%
	> 175	42.8%
PG&E	< 25	64.1%
	25 – 50	80.3%
	50 – 120	80.1%
	120 –175	79.5%
	> 175	78.9%
SCE	< 25	49.5%
	25 – 50	72.3%
	50 – 120	72.0%
	120 –175	71.2%
	> 175	70.4%
SDGE	< 25	38.5%
	25 – 50	66.3%
	50 – 120	65.9%
	120 –175	64.9%
	> 175	63.9%
SMUD	< 25	56.3%
	25 – 50	76.0%
	50 – 120	75.8%
	120 –175	75.1%
	> 175	74.3%

Criteria pollutants will be reduced by reduction in combustion. They will also increase through the increase in energy use. However, the increase may not be in the same air basin.

Discussion:

The output from OFFROAD2007 shows the same emissions within each horsepower tier regardless of the year modeled. Therefore, the emission reduction is dependent on the location of the Project and horsepower of the landscaping equipment only.

Assumptions:

Data based upon the following references:

California Air Resources Board. Off-road Emissions Inventory. OFFROAD2007. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm

California Climate Action Registry Reporting Online Tool. 2006 PUP Reports. Available online at: https://www.climateregistry.org/CARROT/public/reports.aspx

Preferred Literature:

The amount of direct GHG emissions avoided can be calculated using CARB's OFFROAD model, which provides state-wide and regional emission factors for different types of landscaping equipment that can be converted to grams per horsepower-hour [1]. Multiplying this factor by the typical horsepower and load factor of the equipment and number of hours of operation gives the direct GHG emissions. Assuming the same number of operating hours and power output as the gas-powered equipment, the same amount of energy consumption multiplied by the carbon-intensity factor of the local utility gives the amount of indirect GHG emissions associated with using the electric landscape equipment. The GHG emissions reduction associated with this mitigation measure is therefore the difference in emissions from these two scenarios.

Companion Strategy:

In order to take credit for Mitigation Measure 80, a Project Applicant must also commit to providing electrical outlets on the exterior of all buildings (Mitigation Measure 60) so that electrical lawn equipment is compatible with built facilities.

Alternative Literature:

None

Notes:

1. CARB. OFFROAD 2007 Model. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm. Accessed February 2010.

Other Literature Reviewed:

A. USEPA. Lawn Mower Exchange Program Calculator. Available online at: http://www.epa.gov/air/community/mowerexchange_calculator.html. Accessed February 2010.
B. USEPA. Improving Air Quality in Your Community: Outdoor Air – Transportation: Lawn Equipment. Available online at: http://www.epa.gov/air/community/details/yardequip.html. Accessed February 2010.
C. CARB. AB118 Lawn and Garden Equipment Replacement Project. Available online at: http://www.arb.ca.gov/msprog/aqip/lger.htm. Accessed February 2010.
D. SCAQMD. Mow Down Air Pollution Electric Lawn Mower Exchange. Available online at: http://www.aqmd.gov/tao/lawnmower2009.html. Accessed February 2010.
E. VCAPD. Lawn Mower Trade-In Program for Ventura County Residents. Available online at: http://www.vcapcd.org/LawnMower_EN.htm. Accessed February 2010.

F. SMAQMD. Mow Down Air Pollution. Available online at: http://www.airquality.org/mobile/mowdown/index.shtml. Accessed February 2010.

5.1.2 Implement Lawnmower Exchange Program

Range of Effectiveness: Best Management Practice, influences Area GHG emissions from landscape equipment

Measure Description:
When electric and rechargeable battery-powered lawnmowers are used in place of conventional gas-powered lawnmowers, direct GHG emissions from fuel combustion are displaced by indirect GHG emissions associated with the electricity used to power the equipment. The indirect GHG emissions from electricity generation are expected to be significantly less than the direct GHG emissions from gasoline or diesel fuel combustion. Since the magnitude of the GHG emissions reduction depends on the equipment model (including electric power efficiency and battery recharge time), hours of operation, fuel displaced, and number of lawnmowers replaced, the exact GHG emissions reduction is not quantifiable at this time. Therefore, this mitigation measure should be incorporated as a Best Management Practice to allow for educated residents and commercial tenants to reduce their contribution to GHG emissions from landscaping. Many California Air Districts, including eight air districts supported by the CARB Lawn and Garden Equipment Replacement (LGER) Project, already have lawnmower exchange programs in place. This Best Management Practice could involve participating in these established lawnmower exchange programs, supplementing the established programs, or implementing a new program for the Project. The Project Applicant should check with the local air district regarding participating in established programs. The Project Applicant could take quantitative credit for this mitigation measure if detailed and substantial evidence were provided.

Measure Applicability:
- GHG emissions from landscaping

Assumptions:
Data based upon the following references:

- CARB. AB118 Lawn and Garden Equipment Replacement Project. Available online at: http://www.arb.ca.gov/msprog/aqip/lger.htm. Accessed February 2010.
- SCAQMD. Mow Down Air Pollution Electric Lawn Mower Exchange. Available online at: http://www.aqmd.gov/tao/lawnmower2009.html. Accessed February 2010.
- VCAPD. Lawn Mower Trade-In Program for Ventura County Residents. Available online at: http://www.vcapcd.org/LawnMower_EN.htm. Accessed February 2010.
- SMAQMD. Mow Down Air Pollution. Available online at: http://www.airquality.org/mobile/mowdown/index.shtml. Accessed February 2010.

A-2 Landscaping Equipment

Emission Reduction Ranges and Variables:
This is a Best Management Practice and therefore there is no quantifiable reduction at this time. Check with local agencies for guidance on any allowed reductions associated with implementation of best management practices.

Preferred Literature:
CARB's Lawn and Garden Equipment Replacement (LGER) Project was established to encourage the use of cordless zero-emission lawn and garden equipment and to help bring more electric equipment to the market. The LGER Project provides vouchers for electric cordless residential lawn mowers valued up to $250 for each gas-powered lawnmower turned in. The LGER Project provides grants to eight air districts with existing lawnmower exchange programs, including AVAQMD, MDAQMD, SCAQMD, SDAPCD, SJVAPCD, SMAQMD, VCAPCD, and YSAQMD. Individual air districts may offer vouchers of different values.

Alternative Literature:

None

Other Literature Reviewed:

- USEPA. Lawn Mower Exchange Program Calculator. Available online at: http://www.epa.gov/air/community/mowerexchange_calculator.html. Accessed February 2010.
- USEPA. Improving Air Quality in Your Community: Outdoor Air – Transportation: Lawn Equipment. Available online at: http://www.epa.gov/air/community/details/yardequip.html. Accessed February 2010.

5.1.3 Electric Yard Equipment Compatibility

Range of Effectiveness: Best Management Practice, influences Area GHG emissions from landscape equipment. Not applicable on its own. This measure enhances effectiveness of A-1 and A-2.

Measure Description:

This measure is required to be grouped with measures A-1 “Prohibit Gas Powered Landscape Equipment” and A-2 “Implement a Lawnmower Exchange Program.” In order for measures A-1 and A-2 to be feasible, electrical outlets on the exterior of buildings must be accessible so that the electric landscaping equipment can be charged. In this mitigation measure, the Project Applicant commits to providing electrical outlets on the exterior of Project buildings as necessary for sufficient powering of electric lawnmowers and other landscaping equipment.

Measure Applicability:

- This measure is part of a grouped measure
- This measure contributes to reductions in GHG emissions from landscaping

Emission Reduction Ranges and Variables:

This measure is a Best Management Practice grouped with other measures and therefore there is no quantifiable reduction at this time. Check with local agencies for guidance on any allowed reductions associated with implementation of Best Management Practices.

Preferred Literature:

None

6.0 Solid Waste

6.1 Sold Waste

6.1.1 Institute or Extend Recycling and Composting Services

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:
The transport and decomposition of landfill waste and the flaring of landfill gas all produce GHG emissions. Decomposition of waste produces methane, a GHG which has a global warming potential over 20 times that of CO_2. The transport of waste from the site of generation to the landfill produces GHG emissions from the combustion of the fuel used to power the vehicle. Choosing waste management practices which reduce the amount of waste sent to landfills will reduce GHG emissions. Strategies to reduce landfill waste include increasing recycling, reuse, and composting, and encouraging lifestyle choices and office practices which reduce waste generation.

Current protocols for quantifying emissions reductions from diverted landfill waste developed by the USEPA and the California Center for Integrated Waste Management Board (CIWMB) are based on life-cycle approaches, which reflect emissions and reductions in both the upstream and downstream processes around waste management. The Project Applicant should seek local agency guidance on comparing and/or combining operational emissions inventories and life cycle emissions inventories.

Furthermore, while tools are available to quantify the avoided landfill GHG emissions from a specified amount of diverted or recycled waste, taking credit for this mitigation measure also requires the determination of the effects of instituting or extending recycling and composting services. Since both government and privately-sponsored recycling and composting programs vary dramatically in scope, waste materials accepted, and outreach efforts, no literature references exist which provide default values for percent of waste diverted. To take credit for this measure, the Project Applicant would need to provide detailed and substantial evidence supporting the amount of waste reduced or diverted to recycling and composting due to the institution of extended recycling and composting services.

Measure Applicability:

[2] Solid waste disposed to landfill

Inputs:
The following information needs to be provided by the Project Applicant:

- For residential buildings: number of residents
- For shopping malls and office buildings: building square footage
- For public venues: annual number of visitors
- For all other commercial buildings: number of employees
- Waste disposal method
- Amount of waste reduced or diverted to recycling and composting due to the institution of extended recycling and composting services.

Baseline Method:
The Project Applicant must first calculate the total amount of waste generated at the project.

For residential buildings and all commercial buildings except shopping malls and offices:

$$Waste_{baseline\ total} = People \times DisposalRate$$

For shopping malls and office buildings:

$$Waste_{baseline\ total} = SF \times DisposalRate$$

Where:

People = Number of residents, employees, or visitors (for public venues)
Provided by Applicant
SF = Square feet of building
Provided by Applicant
DisposalRate = Annual disposal rate of waste (tons/resident/year, tons/employee/year, or tons/visitor/year)
From Tables SW-1.1 and SW-1.2

The total waste stream is then portioned into material-specific streams (paper, glass, metal, plastic, etc.) using the percentages listed in Table SW-1.3.

USEPA's Waste Reduction Model (WARM) is used to quantify baseline emissions and emissions reductions from diverting landfill waste to composting or recycling. This web-based tool is available online at http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_Form.html. The required inputs are the tons of waste associated with one of three waste management practices: landfill (baseline scenario), recycled (mitigated scenario), combusted (not applicable in California), and composted (mitigated scenario). The amount of each type of waste in tons is entered into the "Tons Landfilled" column in the Baseline Scenario of

WARM to calculate the baseline GHG emissions in metric MT carbon equivalent (MTCE). Other input variables include landfill type (presence of landfill gas control system or not) and distance of waste transport; however, default values can be used.

Mitigation Method:
In WARM, the project applicant specifies the amount of waste associated with each of the three alternative scenarios: waste reduced (e.g. reduced waste generation), waste recycled, and waste composted. WARM then calculates the GHG savings associated with the alternative scenarios as compared with the baseline scenario.

Assumptions:
Data based upon the following reference:

- USEPA. 2009. Waste Reduction Model. Available online at: http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html
- CIWMB. 1999. Statewide Waste Characterization Study: Final Results and Report. Available online at: http://www.calrecycle.ca.gov/publications/LocalAsst/34000009.pdf
- CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. Available online at: http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry

Preferred Literature:
USEPA's WARM was developed to track GHG emission reductions from various waste management options. This tool calculates the GHG emissions associated with a baseline waste management strategy, as well as those associated with an alternative strategy that may include source reduction, recycling, composting, combusting, or landfilling. WARM then calculates the GHG savings associated with the alternative strategy as compared with the baseline strategy. WARM requires input of the estimated tons of waste per material type per disposal strategy. There are 34 different material types (e.g., aluminum cans, mixed paper, yard trimmings, carpet). Other input variables include landfill type (presence of landfill gas control system or not) and distance of waste transport; however, default values can be used. Note that WARM was developed based on a life-cycle approach, which reflects emissions and reductions in both the upstream and downstream processes around waste management. USEPA notes that emission factors developed based on this life cycle approach are not appropriate for use in GHG inventories.

Alternative Literature:
None

Other Literature Reviewed:

- HF&H Consultants. 2008. 5-Year Audit Program Assessment and Final Report. Prepared for StopWaste.Org. Available online at: http://www.stopwaste.org/docs/revised_assessment_report-final_1-08.pdf
- StopWaste.Org. 2008. Multifamily Dwelling Recycling Evaluation Report. Available online at: http://www.stopwaste.org/docs/mfd_evaluation_rpt.pdf

Table SW-1.1
Residential Waste Disposal Rates

Multi-family Homes		
All Counties	All Regions	**Annual Disposal Rate (tons/resident/year)**
		0.46

Single-family Homes		
County	**Region**	**Annual Disposal Rate (tons/resident/year)**
Alameda	Bay Area	0.42
Alpine	Mountain	0.25
Amador	Mountain	0.25
Butte	Central Valley	0.36
Calaveras	Mountain	0.25
Colusa	Central Valley	0.36
Contra Costa	Bay Area	0.42
Del Norte	Coastal	0.44
El Dorado	Mountain	0.25
Fresno	Central Valley	0.36
Glenn	Central Valley	0.36
Humbolt	Coastal	0.44
Imperial	Southern	0.41
Inyo	Mountain	0.25
Kern	Southern	0.41
Kings	Central Valley	0.36
Lake	Central Valley	0.36
Lassen	Mountain	0.25
Los Angeles	Southern	0.41
Madera	Central Valley	0.36
Marin	Bay Area	0.42
Mariposa	Mountain	0.25
Mendocino	Coastal	0.44
Merced	Central Valley	0.36
Modoc	Mountain	0.25
Mono	Mountain	0.25

Single-family Homes		
County	**Region**	**Annual Disposal Rate (tons/resident/year)**
Monterey	Coastal	0.44
Napa	Bay Area	0.42
Nevada	Mountain	0.25
Orange	Southern	0.41
Placer	Central Valley	0.36
Plumas	Mountain	0.25
Riverside	Southern	0.41
Sacramento	Central Valley	0.36
San Benito	Coastal	0.44
San Bernardino	Southern	0.41
San Diego	Southern	0.41
San Francisco	Bay Area	0.42
San Joaquin	Central Valley	0.36
San Luis Obispo	Southern	0.41
San Mateo	Bay Area	0.42
Santa Barbara	Southern	0.41
Santa Clara	Bay Area	0.42
Santa Cruz	Coastal	0.44
Shasta	Mountain	0.25
Sierra	Mountain	0.25
Siskiyou	Mountain	0.25
Solano	Bay Area	0.42
Sonoma	Coastal	0.44
Stanislaus	Central Valley	0.36
Sutter	Central Valley	0.36
Tehama	Central Valley	0.36
Trinity	Mountain	0.25
Tulare	Central Valley	0.36
Tuolumne	Mountain	0.25
Ventura	Southern	0.41
Yolo	Central Valley	0.36
Yuba	Central Valley	0.36

Source:

Single-family Homes		
County	**Region**	**Annual Disposal Rate (tons/resident/year)**

CalRecycle. Solid Waste Characterization Database: Residential Waste Disposal Rates. Available online at: http://www.calrecycle.ca.gov/wastechar/Resdisp.htm

CIWMB. 1999. Statewide Waste Characterization Study: Final Results and Report. Available online at: http://www.calrecycle.ca.gov/publications/LocalAsst/34000009.pdf.

Table SW-1.2
Commercial Waste Disposal Rates

Commercial Industry	Annual Disposal Rate	
Fast-Food Restaurants	2.1	tons/employee/year
Full-Service Restaurants	2.2	tons/employee/year
Food Stores	2.4	tons/employee/year
Durable Wholesale Distributors	1.2	tons/employee/year
Non-Durable Wholesale Distributors	1.4	tons/employee/year
Large Hotels	2.0	tons/employee/year
Building Material & Gardening, Big-Box Stores	3.2	tons/employee/year
Building Material & Gardening, Other Stores	1.7	tons/employee/year
Retail, Big-Box Stores	1.4	tons/employee/year
Retail, Other Stores	0.9	tons/employee/year
Shopping Malls, Anchor Stores	1.1	tons/1,000 sqft/year
Shopping Malls, Other	1.0	tons/1,000 sqft/year
Public Venues and Events	0.1	tons/100 visitors/year
Large Office Buildings	0.9	tons/1,000 sqft/year

Abbreviations:
lb - pound
sqft - square feet

Source:

CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. Table 2. Available online at: http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry

Table SW-1.3
Waste Streams and Percent of Disposed Waste

Building Category	Disposed Waste Streams							
	Paper [Mixed Paper, Broad Definition]	Glass [Glass]	Metal [Mixed Metals]	Plastic [Mixed Plastics]	Electronics [Personal Computers]	Organics [Mixed Organics]	Construction & Demolition [Clay Bricks, Concrete]	Household Hazardous, Special, and Mixed Residue [Mixed MSW]
Residential	27.4%	4.0%	4.6%	8.8%	n/a	45.0%	4.5%	5.5%
Fast-Food Restaurants	33.0%	0.6%	1.6%	11.6%	0.0%	52.5%	0.6%	0.0%
Full-Service Restaurants	17.3%	2.7%	2.8%	7.3%	0.1%	66.5%	1.8%	1.5%
Food Stores	18.5%	0.5%	1.4%	9.5%	0.0%	65.0%	5.0%	0.0%
Durable Wholesale Distributors	26.3%	0.7%	11.4%	9.9%	0.5%	5.4%	43.5%	2.4%
Non-Durable Wholesale Distributors	26.5%	0.5%	3.3%	16.0%	2.6%	32.7%	18.4%	0.1%
Large Hotels	32.3%	4.7%	3.8%	9.7%	0.4%	44.2%	4.8%	0.1%
Building Material & Gardening, Big-Box Stores	12.2%	1.9%	8.3%	7.1%	1.2%	8.0%	60.1%	1.2%
Building Material & Gardening, Other Stores	13.4%	5.3%	3.9%	7.1%	1.9%	18.6%	47.4%	2.3%
Retail, Big-Box Stores	21.7%	1.1%	5.3%	16.0%	0.8%	23.6%	27.1%	4.4%
Retail, Other Stores	31.8%	6.2%	8.7%	14.4%	0.7%	17.5%	15.0%	5.7%
Shopping Malls, Anchor Stores	37.9%	5.0%	3.0%	28.8%	0.1%	15.5%	9.1%	0.5%
Shopping Malls, Other	32.7%	1.8%	2.3%	19.6%	0.2%	35.9%	5.3%	2.0%
Public Venues and Events	42.0%	5.5%	1.8%	14.8%	0.0%	34.0%	0.7%	1.2%
Large Office Buildings	50.3%	1.8%	1.6%	12.5%	0.1%	24.4%	8.3%	1.1%

Abbreviations:
MSW - municipal solid waste

Notes:
The USEPA report identifies waste streams with slightly different names than the CIWMB report. The CIWMB and USEPA waste stream categories were paired; USEPA categories are shown in brackets [ ] above.

Sources:
CIWMB. 1999. Statewide Waste Characterization Study: Final Results and Report. Available online at: http://www.calrecycle.ca.gov/publications/LocalAsst/34000009.pdf
CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. Available online at: http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry
USEPA. 2006. Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks. Available online at: http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html

6.1.2 Recycle Demolished Construction Material

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:
Recycling demolished construction material can contribute to GHG reductions in multiple ways. First, it displaces new construction materials, thereby reducing the need for new raw material acquisition and manufacturing of those new construction materials. Harvesting of raw materials and manufacturing new materials requires energy in the form of fuel combustion and electricity, both of which are associated with GHG emissions. If the process of recycling construction materials is less carbon-intensive than the processes required to harvest and produce new construction materials, recycling these construction materials results in a net reduction in GHG emissions. Second, using local recycled construction material reduces the emissions associated with the transportation of new construction materials, which are typically manufactured farther away from a project site. Third, recycling construction material avoids sending this material to landfills. Wood-based materials decompose in landfills and contribute to methane emissions.

Unlike measures which reduce GHG emissions during the operational lifetime of a project, such as reducing building electricity and water usage, this mitigation effort is realized prior to the actual operational lifetime of a project. Therefore, these GHG emissions reductions are best quantified in terms of a life-cycle analysis. Life cycle analyses examine all stages of the life of a product, including raw material acquisition, manufacture, transportation, installation, use, and disposal or recycling. The Project Applicant should seek local agency guidance on comparing and/or combining operational emissions inventories and life cycle emissions inventories.

Measure Applicability:

- Life cycle emissions from construction materials

Preferred Literature:
The California Integrated Waste Management Board (CIWMB) cites decreases in greenhouse gas emissions as a benefit of construction waste management and recycling in its document “Construction Waste Management” which is used as part of California Sustainable Design Training. The document is available online at:
www.calrecycle.ca.gov/greenbuilding/training/statemanual/waste.doc

Alternative Literature:
None

Other Literature Reviewed:
None

7.0 Vegetation

7.1 Vegetation

7.1.1 Urban Tree Planting

Range of Effectiveness: CO_2 reduction varies by the number of trees. VOC emissions may increase.

Measure Description:

Planting trees sequesters CO_2 while the trees are actively growing. The amount of CO_2 sequestered depends on the type of tree. IPCC indicates that in most cases, the active growing period of a tree is 20 years and after this time the amount of carbon in biomass slows and will be completely offset by losses from clipping, pruning, and occasional death [1]. Therefore, the emissions only occur for a 20 year period and are summed over all years to give a net one-time GHG benefit.

If large areas of trees will be planted, the lead agency may want to ensure enforceability by requiring submission of annual inventory consistent with the Urban Forest Protocol [2]. This is a comprehensive protocol that requires maintenance and replacement of trees. If the Project Applicant desires to use this approach, calculation methodologies and assumptions presented in the protocol should be used. The information required to implement this protocol is often not available at the time of the CEQA process.

The type of tree species planted will result in varying degrees of carbon sequestration. In addition, trees emit volatile organic compounds (VOCs), which are criteria pollutant precursors. Therefore the Project Applicant may want to consider these issues when selecting the type of tree to plant. See [3] for details on low-VOC trees.

Measure Applicability:

- New trees

Inputs:

The following information needs to be provided by the Project Applicant:

- Species classes of trees planted, if known
- Number of net new trees in each species class, if known
- Total number of net new trees

Baseline Method:

In the baseline case, there are no net new trees planted.

Mitigation Method:

Look up default annual CO_2 sequestration rates on a per tree basis:

Broad species class	Default annual CO_2 accumulation per tree[1] (MT CO_2/ year)
Aspen	0.0352
Soft maple	0.0433
Mixed hardwood	0.0367
Hardwood maple	0.0521
Juniper	0.0121
Cedar/larch	0.0264
Douglas fir	0.0447
True fir/Hemlock	0.0381
Pine	0.0319
Spruce	0.0337
Miscellaneous[2]	0.0354

1. IPCC's carbon (C) values converted to carbon dioxide (CO_2) using ratio of molecular weights (44/12).
2. Average of all other broad species classes. To be assumed if tree type is not known.

Therefore, the reduction in GHG emissions associated with planting new trees is:

$$\text{GHG emission reduction} = (\text{Growing Period} \times \sum_{i=1}^{n} [\text{ Sequestration } i \times \text{Trees } i\,]\,) \div \text{Total GHG emissions}$$

Where:

GHG emission reduction = Percentage reduction in GHG emissions as compared to total GHG emissions.
Growing Period = Growing period for all trees, expressed in years (20).
n = Number of broad species classes. Provided by Applicant.
Sequestration *i* = Default annual CO_2 accumulation per tree for broad species class *i*. Lookup in table above.
Trees *i* = Number of net new trees of broad species class *i*.
Total GHG emissions = Total GHG emissions. Provided by Applicant.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Varies based on number of trees
VOC	May increase
All other pollutants	Not Quantified

Discussion:

If the applicant has baseline total project emissions of 5,000 MT CO_2e per year, and if the applicant elects to mitigate GHG emissions by committing to planting 500 net new "miscellaneous" trees, the applicant would reduce the amount of GHG emissions associated with the project by 7%.

$$\text{GHG Emission Reduced} = \frac{20 \times 0.0354 \times 500}{5{,}000} = 0.07 \text{ or } 7\%$$

Assumptions:

Data based upon the following reference:

[1] IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 8.2. Available online at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_08_Ch8_Settlements.pdf

Preferred Literature:

The IPCC Guidelines [1] provide a method for estimating the amount of carbon sequestered by trees. IPCC default annual CO_2 sequestration rates on a per tree basis are used. Table 8.2 of the IPCC Guidelines provides species class-specific sequestration values. For species that do not appear or if the species is unknown, the average value from Table 8.2 (0.035 MT CO_2 per year per tree) can be assumed to be representative of trees planted. Urban trees are only net carbon sinks when they are actively growing. The IPCC assumes an active growing period of 20 years (see p. 8.9). Thereafter, the accumulation of carbon in biomass slows with age, and will be completely offset by losses from clipping, pruning, and occasional death. Actual active growing periods are subject to, among other things, species, climate regime, and planting density. Additional credit may be taken for planting native trees. See WUW-3 for details on the design of water-efficient landscaping.

Alternative Literature:

The Center for Urban Forest Research Tree Carbon Calculator is based on a small set of data and extrapolates annual tree girth increases for various tree species [1]. Furthermore, it extrapolates the amount of carbon associated with a given girth for each tree species. This method is based on extrapolation of a limited dataset. In addition it requires considerably more input requirements that may not be available for CEQA projects. These inputs include knowledge of specific tree species that will be planted and assumptions regarding anticipated growth rates. Considering the order of magnitude of mitigation from this option, the additional complexity of this method would not generally be warranted for most CEQA projects.

The CAR Urban Forest Sector Protocol [2] provides guidelines for estimating the amount of CO_2 sequestered by common California tree species. This methodology would require Project Applicants to know the tree species to be planted at the time the CEQA analysis is prepared. Furthermore, this methodology would require Project Applicants to estimate the expected diameter of trees, which is dependent on climate and tree sub-species, among other things.

Alternative Literature References:

[2] CAR. 2010. Urban Forest Project Protocol Version 1.1. Available online at: http://www.climateactionreserve.org/how/protocols/adopted/urban-forest/current-urban-forest-project-protocol/

[3] The Center for Urban Forest Research Tree Carbon Calculator. Available online at: http://www.fs.fed.us/ccrc/topics/urban-forests/

Other Literature Reviewed:

None

7.1.2 Create New Vegetated Open Space

Range of Effectiveness: varies based on amount and type of land vegetated

Measure Description:

A development which re-vegetates or creates vegetated land from previously settled land sequesters CO_2 from the atmosphere which would not have been captured had there been no land-type change. There is no reduction in GHG emissions associated with preservation of a land.

Measure Applicability:

- Open space

Inputs:

The following information needs to be provided by the Project Applicant:

- Types of land uses created
- Acres of each land use created

Baseline Method:

In the baseline case, there is no preserved or created open space.

Mitigation Method:

Lookup carbon dioxide sequestered per acre for each land use that will be preserved or created:

Land Use	Sub-Category	Default annual CO_2 accumulation per acre[1] (MT CO_2/ acre)
Forest Land	Scrub	14.3
	Trees	111
Cropland	--	6.9
Grassland	--	4.31
Wetlands	--	0

1. Calculated by multiplying total biomass (MT dry matter/acre) from IPCC data by the carbon fraction in plant material (0.47), then using the ratio of molecular weights (44/12) to convert from MT of carbon (C) to MT of carbon dioxide (CO_2).

Land uses are defined by IPCC as follows:

(i) Forest Land

This category includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but *in situ* could potentially reach the threshold values used by a country to define the Forest Land category.

(ii) Cropland

This category includes cropped land, including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the Forest Land category.

(iii) Grassland

This category includes rangelands and pasture land that are not considered Cropland. It also includes systems with woody vegetation and other non-grass vegetation such as herbs and brushes that fall below the threshold values used in the Forest Land category. The category also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastural systems, consistent with national definitions.

(iv) Wetlands

This category includes areas of peat extraction and land that is covered or saturated by water for all or part of the year (e.g., peatlands) and that does not fall into the Forest Land, Cropland, Grassland or Settlements categories. It includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.

$$\text{GHG emission reduction} = \left(\sum_{i=1}^{n} [\text{ Sequestration } i \text{ x Acres } i\text{]} \right) \div \text{Total GHG emissions}$$

Where:

GHG emission reduction	=	Percentage reduction in GHG emissions as compared to total GHG emissions.
n	=	Number of land uses. Provided by Applicant.
Sequestration *i*	=	Default annual CO_2 accumulation per acre for land use *i.* Look up in table above.
Acres *i*	=	Number of acres of land use *i.*
Total GHG emissions	=	Total one-time GHG emissions. Provided by Applicant.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Varies
All other pollutants	Not Quantified

Discussion:

If the applicant has baseline one-time emissions of 5,000 MT CO_2e per year, and if the applicant elects to mitigate GHG emissions by committing to creating 50 acres of forest land (scrub) and 20 acres of grassland, the applicant would reduce the amount of one-time GHG emissions by 16%.

$$\text{GHG Emission Reduced} = \frac{14.3 \times 50 + 4.31 \times 20}{5{,}000} = 0.16 \text{ or } 16\%$$

Assumptions:

Data based upon the following references:

[1] IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4. Available online at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

Preferred Literature:

The IPCC Guidelines provide a method for calculating changes in CO_2 sequestration due to land-type conversions. While other methods exist, notably the CCAR Forest Protocol [2], the IPCC Guidelines [1] have more general default values available that will be applicable to all areas of California without requiring detailed site-specific information. A general knowledge of the proposed change in land type is sufficient to quantify reductions in greenhouse gas emissions. IPCC designates four general vegetation types: forest land, cropland, grassland, and wetland. The amount of sequestered CO_2 is calculated based on the amount of carbon stock in each type of biomass (MT carbon / hectare vegetation). IPCC defaults for the carbon stock in each vegetation type are summarized in Table 8.4. (Note that this table represents the amount of carbon removed due to land conversion to settlements; it can also be used to calculate the amount of carbon sequestered due to conversion from settlement to vegetated land. Note also that a conversion to wetlands is not relevant for California). In addition to general default values, the IPCC Guidelines have climate and species-specific data available which can be used if details of the proposed development are known. To calculate the final mass of CO_2, the mass of carbon is then multiplied by 3.67, which is the ratio of molecular mass of CO_2 to the molecular mass of carbon. This method assumes that all of the carbon is converted into CO_2, which is appropriate for most CEQA projects.

Alternative Literature:

The CAR Forest Sector Protocol provides guidelines for estimating the amount of CO_2 sequestered by vegetated land [1]. The Protocol is specific to forest land only, and is not appropriate for estimating land-type conversions to or from cropland or grassland. Additionally, the methodology is limited to conversions from vegetated land to settlement or settlement to vegetated land, but is not appropriate for changes from one vegetated land type to another vegetated land type. The Protocol recommends accounting for changes in the organic carbon content of soil, which requires soil sampling and testing. While testing of existing soil is feasible, the protocol does not provide adequate methods for predicting the future soil organic carbon content after a land-type conversion has taken places. Furthermore, soil testing may be a burdensome task for a Project Applicant. Methodologies which provide default values, such as the IPCC Guidelines, are preferable.

Alternative Literature References:

[2] CAR. 2010. Urban Forest Project Protocol Version 1.1. Available online at: http://www.climateactionreserve.org/how/protocols/adopted/urban-forest/current-urban-forest-project-protocol/

Other Literature Reviewed:

None

8.0 Construction

8.1 Construction

8.1.1 Use Alternative Fuels for Construction Equipment

Range of Effectiveness: 0 – 22% reduction in GHG emissions

Measure Description:

When construction equipment is powered by alternative fuels such as compressed natural gas rather than conventional petroleum diesel or gasoline, GHG emissions from fuel combustion may be reduced.

Measure Applicability:

[3] Construction vehicles

Inputs:

The following information needs to be provided by the Project Applicant:

- Fuel type and Horsepower of Construction Equipment
- Hours of operation

Baseline Method:

For all pollutants besides ROG emissions from gasoline-fueled equipment, total emission is equivalent to exhaust emission and is calculated as follows:

$$\text{Exhaust Emission} = \frac{\text{Exhaust}}{\text{Activity} \times \text{AvgHP}} \times \text{Hp} \times \text{Hr} \times \text{C}$$

Where:

Exhaust Emission= MT or tons of pollutant per year

Exhaust = Statewide daily emission from equipment for the relevant horsepower tier of diesel or gasoline fuel (tons/day). Obtained from OFFROAD2007.

Activity = Statewide daily average operating hours for the relevant horsepower tier (hours/day). Obtained from OFFROAD2007.

AvgHP = Average horsepower for the relevant horsepower tier (HP). Obtained from OFFROAD2007.

Hp = Horsepower of equipment.

Hr = Hours of operation.

C = Unit conversion factor

Note that this method assumes the load factor of the equipment is same as the default in OFFROAD2007.

Total GHG emission is calculated as follows:

$$\text{GHG Emission} = CO_2 \text{ Emission} + CH_4 \text{ Emission} \times 21 + N_2O \text{ Emission} \times 310$$

Where:

GHG Emission = MT CO_2e
CO_2 Emission = CO_2 emission calculated as described above with data from OFFROAD2007.
CH_4 Emission = CH_4 emission calculated as described above with data from OFFROAD2007.
N_2O Emission = N_2O emission calculated as described above with data from OFFROAD2007.
21 = Global warming potential of CH_4 following CCAR GPR 2009.
310 = Global warming potential of N_2O following CCAR GPR 2009.

Total ROG emission from gasoline-fueled equipment is calculated as follows:

$$\text{Total ROG Emission} = \text{Exhaust ROG Emission} + \frac{\text{Resting} + \text{Diurnal} + \text{Hot Soak} + \text{Evaporative}}{\text{Activity} \times \text{AvgHP}} \times \text{Hp} \times \text{Hr} \times \text{C}$$

Where:

Total ROG Emission = Tons of ROG emission per year
Exhaust ROG Emission = ROG emission from exhaust calculated as described above (tons/year)
Resting = Statewide daily resting losses from equipment for the relevant horsepower tier (tons/day). Obtained from OFFROAD2007.
Diurnal = Statewide daily diurnal losses from equipment for the relevant horsepower tier (tons/day). Obtained from OFFROAD2007.
Hot Soak = Statewide daily hot soak losses from equipment for the relevant horsepower tier (tons/day). Obtained from OFFROAD2007.
Evaporative = Statewide daily evaporative losses from equipment for the relevant horsepower tier (tons/day). Obtained from OFFROAD2007.
Activity = Statewide daily average operating hours for the relevant horsepower tier (hours/day). Obtained from OFFROAD2007.
AvgHP = Average horsepower for the relevant horsepower tier (HP). Obtained from OFFROAD2007.
Hp = Horsepower of TRU.
Hr = Hours of operation.
C = Unit conversion factor

Mitigation Method:

Mitigated emissions for this measure are calculated using the same method as baseline method, but with emission factors from compressed natural gas in OFFROAD2007.

Emission Reduction Ranges and Variables:

GHG and criteria pollutant emission reductions from switching diesel or gasoline fuel to compressed natural gas fuel for different years are listed in accompanying tables. Only equipment with emission data for compressed natural gas and either diesel or gasoline fuel in OFFROAD2007 are included.

Discussion:

The emission changes vary over a large range for different pollutants and equipment and between diesel and gasoline. In fact, GHG emissions for several types of equipment running on gasoline and all equipment running on diesel would increase from switching to compressed natural gas, as reflected by the negative reductions in the tables. On the other hand, SO_2 emissions are 100% reduced as there is no SO_2 emissions from equipment running on compressed natural gas according to OFFROAD2007. Other trends include no significant change in PM emissions for most gasoline equipment, considerable decrease in CO emissions from gasoline equipment but significant increase in CO emissions from diesel equipment. Therefore, the Project Applicant has to weigh the costs and benefits from switching to compressed natural gas on a case-by-case basis.

Assumptions:

Data based upon the following references:

- California Air Resources Board. Off-road Emissions Inventory. OFFROAD2007. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm
- California Climate Action Registry (CCAR). 2009. General Reporting Protocol. Version 3.1. Available online at: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html
  California Climate Action Registry Reporting Online Tool. 2006 PUP Reports. Available online at: https://www.climateregistry.org/CARROT/public/reports.aspx

Preferred Literature:

GHG emissions from the combustion of conventional petroleum diesel and gasoline fuel can be calculated using CARB's OFFROAD model emission factors [1]. The model provides state-wide and regional emission factors that can be converted to grams per horsepower-hour. Multiplying this factor by the typical horsepower of the equipment and the estimated number of hours of operation gives the total GHG emissions. In this mitigation measure, compressed natural gas was chosen as the alternative fuel. Emission factors for compressed natural gas can also be obtained from OFFROAD The

GHG emissions reduction associated with this mitigation measure is therefore the difference in emissions from using petroleum diesel or gasoline versus using compressed natural gas. Other types of alternative fuels besides compressed natural gas exist. In order to take credit for this mitigation measure, the Project Applicant would need to provide detailed and substantial documentation showing expected reductions in GHG emissions as a result of running construction equipment on these alternative fuels rather than petroleum diesel or gasoline. One potential issue with quantifying this mitigation measure is the difference in fuel economy between petroleum diesel and alternative fuels.

Alternative Literature:

Many USDOE, NREL, and USEPA reports exist which present data on exhaust emissions from engines operating with alternative fuels. The majority of these reports focuses on oxides of nitrogen (NOx) and particulate matter (PM) emissions and have limited CO_2 emissions and fuel economy data. One NREL report shows CO_2 emissions and fuel economy for three ethanol/diesel blends (7.7%, 10%, and 15%) in three off-road engines (6.8, 8.1, and 12.5 L) and compares the results to engine performance using conventional diesel fuel [5]. However, this report presented engine-specific data from a small study size. Issues with other reports include the study's focus on on-road engines rather than off-road engines which would be used in construction equipment. It would be difficult to generalize the data contained in these reports for a Project Applicant's ease of use.

Notes:

[1] CARB. OFFROAD 2007 Model. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm. Accessed February 2010.

Other Literature Reviewed:

[2] USEPA. 2002. A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions. Available online at: http://www.epa.gov/otaq/models/analysis/biodsl/p02001.pdf
[3] USDOE. NREL: ReFUEL Laboratory: Data and Resources. Available online at: http://www.nrel.gov/vehiclesandfuels/refuellab/data_resources.html. Accessed March 2010.
[4] USDOE. 2006. NREL: Effects of Biodiesel Blends on Vehicle Emissions. Available online at: http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/40554.pdf
[5] USDOE. 2003. NREL: The Effect of Biodiesel Composition on Engine Emissions from a DDC Series 60 Diesel Engine. Available online at: http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/31461.pdf

Table C-1.1
Emission Reduction Due to Fuel Switch from Gasoline to Compressed Natural Gas

Equipment	Horsepower	2004					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	59%	-27%	36%	91%	98%	100%
	15 - 25	61%	-40%	7%	90%	97%	100%
Air Conditioner	< 175	24%	14%	19%	0%	97%	100%
Baggage Tug	< 120	46%	15%	-4%	0%	93%	100%
Belt Loader	< 120	52%	18%	3%	0%	95%	100%
Bobtail	< 120	55%	17%	19%	0%	95%	100%
Cargo Loader	< 120	41%	16%	2%	0%	93%	100%
Catering Truck	< 250	31%	12%	25%	0%	94%	100%
Forklifts	< 25	53%	-46%	23%	-85%	92%	100%
	25 - 50	94%	22%	-33%	0%	97%	100%
	50 - 120	58%	19%	18%	0%	96%	100%
	120 - 175	24%	17%	24%	0%	94%	100%
Fuel Truck	<175	3%	18%	17%	0%	99%	100%
Generator Sets	<120	52%	18%	14%	0%	96%	100%
	120 - 175	22%	14%	21%	0%	95%	100%
Lav Truck	<175	32%	18%	17%	0%	94%	100%
Lift	<120	53%	17%	14%	0%	96%	100%
Passenger Stand	<175	27%	15%	22%	0%	96%	100%
Service Truck	<250	13%	16%	26%	0%	95%	100%

Equipment	Horsepower	2010					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	58%	-27%	39%	91%	96%	100%
	15 - 25	58%	-37%	32%	90%	95%	100%
Air Conditioner	< 175	29%	14%	19%	0%	98%	100%
Baggage Tug	< 120	13%	13%	-114%	0%	84%	100%
Belt Loader	< 120	27%	15%	-82%	0%	91%	100%
Bobtail	< 120	29%	16%	11%	0%	96%	100%
Cargo Loader	< 120	15%	14%	-70%	0%	89%	100%
Catering Truck	< 250	35%	12%	29%	0%	95%	100%
Forklifts	< 25	53%	-51%	3%	-85%	85%	100%
	25 - 50	95%	22%	18%	0%	98%	100%
	50 - 120	52%	18%	5%	0%	95%	100%
	120 - 175	27%	14%	23%	0%	94%	100%
Fuel Truck	<175	9%	16%	15%	0%	100%	100%
Generator Sets	<120	40%	17%	16%	0%	97%	100%
	120 - 175	26%	14%	23%	0%	95%	100%
Lav Truck	<175	36%	15%	-18%	0%	94%	100%
Lift	<120	44%	17%	16%	0%	96%	100%

Passenger Stand	<175	32%	15%	25%	0%	97%	100%
Service Truck	<250	19%	14%	40%	0%	95%	100%

Equipment	Horsepower	2015					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	58%	-27%	39%	91%	96%	100%
	15 - 25	58%	-37%	32%	90%	94%	100%
Air Conditioner	< 175	31%	13%	23%	0%	99%	100%
Baggage Tug	< 120	8%	14%	-93%	0%	85%	100%
Belt Loader	< 120	22%	16%	-69%	0%	92%	100%
Bobtail	< 120	25%	16%	13%	0%	96%	100%
Cargo Loader	< 120	5%	14%	-91%	0%	88%	100%
Catering Truck	< 250	38%	11%	33%	0%	95%	100%
Forklifts	< 25	53%	-51%	3%	-85%	84%	100%
	25 - 50	95%	22%	34%	0%	98%	100%
	50 - 120	52%	18%	6%	0%	95%	100%
	120 - 175	27%	14%	25%	0%	95%	100%
Fuel Truck	<175	12%	15%	13%	0%	100%	100%
Generator Sets	<120	21%	16%	17%	0%	97%	100%
	120 - 175	29%	13%	24%	0%	96%	100%
Lav Truck	<175	36%	15%	-24%	0%	95%	100%
Lift	<120	37%	16%	16%	0%	96%	100%
Passenger Stand	<175	34%	14%	28%	0%	98%	100%
Service Truck	<250	22%	13%	46%	0%	96%	100%

Equipment	Horsepower	2020					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	58%	-27%	39%	91%	96%	100%
	15 - 25	58%	-37%	32%	90%	94%	100%
Air Conditioner	< 175	32%	13%	24%	0%	99%	100%
Baggage Tug	< 120	7%	15%	-49%	0%	89%	100%
Belt Loader	< 120	21%	16%	-27%	0%	94%	100%
Bobtail	< 120	26%	16%	13%	0%	96%	100%
Cargo Loader	< 120	3%	15%	-62%	0%	91%	100%
Catering Truck	< 250	39%	11%	36%	0%	96%	100%
Forklifts	< 25	53%	-51%	3%	-85%	84%	100%
	25 - 50	95%	22%	36%	0%	98%	100%
	50 - 120	52%	18%	8%	0%	95%	100%
	120 - 175	27%	14%	26%	0%	95%	100%
Fuel Truck	<175	12%	14%	9%	0%	100%	100%
Generator Sets	<120	-5%	16%	17%	0%	98%	100%
	120 - 175	30%	13%	25%	0%	97%	100%
Lav Truck	<175	36%	15%	3%	0%	96%	100%

Lift	<120	30%	16%	15%	0%	97%	100%
Passenger Stand	<175	35%	14%	30%	0%	98%	100%
Service Truck	<250	23%	13%	42%	0%	96%	100%

Equipment	Horsepower	2025					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	58%	-27%	39%	91%	96%	100%
	15 - 25	58%	-37%	32%	90%	94%	100%
Air Conditioner	< 175	32%	13%	27%	0%	99%	100%
Baggage Tug	< 120	8%	15%	-27%	0%	92%	100%
Belt Loader	< 120	21%	17%	-7%	0%	96%	100%
Bobtail	< 120	25%	16%	13%	0%	96%	100%
Cargo Loader	< 120	3%	16%	-40%	0%	93%	100%
Catering Truck	< 250	39%	11%	36%	0%	96%	100%
Forklifts	< 25	53%	-51%	3%	-85%	84%	100%
	25 - 50	95%	21%	36%	0%	98%	100%
	50 - 120	52%	18%	8%	0%	95%	100%
	120 - 175	27%	14%	26%	0%	95%	100%
Fuel Truck	<175	13%	14%	13%	0%	100%	100%
Generator Sets	<120	-15%	16%	18%	0%	98%	100%
	120 - 175	30%	13%	26%	0%	98%	100%
Lav Truck	<175	36%	15%	22%	0%	97%	100%
Lift	<120	27%	16%	15%	0%	97%	100%
Passenger Stand	<175	35%	13%	30%	0%	99%	100%
Service Truck	<250	24%	12%	34%	0%	96%	100%

Table C-1.2
Emission Reduction Due to Fuel Switch from Diesel to Compressed Natural Gas

Equipment	Horsepower	2004					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	-2749%	-27%	55%	36%	73%	100%
	15 - 25	-2912%	-31%	46%	26%	74%	100%
Air Conditioner	<175	-451%	-21%	-30%	84%	87%	100%
Baggage Tug	<120	-507%	-24%	10%	94%	88%	100%
Belt Loader	<120	-469%	-23%	6%	93%	89%	100%
Bobtail	<120	-441%	-22%	23%	93%	91%	100%
Cargo Loader	<120	-625%	-25%	-4%	93%	84%	100%
Catering Truck	<250	-1152%	-22%	-44%	70%	78%	100%
Forklifts	<50	-21%	-23%	-51%	93%	95%	100%
	50 - 120	-594%	-25%	5%	93%	87%	100%
	120 - 175	-581%	-22%	-2%	88%	89%	100%
Generator Sets	<120	-397%	-12%	-2%	92%	91%	100%
	<175	-415%	-12%	-11%	85%	89%	100%
Lav Truck	<175	-457%	-22%	-11%	88%	89%	100%
Lift	<120	-465%	-23%	-5%	92%	89%	100%

Equipment	Horsepower	2010					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	-3037%	-27%	31%	-29%	59%	100%
	15 - 25	-3755%	-32%	40%	-3%	60%	100%
Air Conditioner	<175	-450%	-20%	-36%	73%	85%	100%
Baggage Tug	<120	-556%	-22%	22%	92%	88%	100%
Belt Loader	<120	-513%	-22%	21%	92%	90%	100%
Bobtail	<120	-480%	-19%	64%	91%	96%	100%
Cargo Loader	<120	-678%	-24%	6%	91%	84%	100%
Catering Truck	<250	-1732%	-21%	-38%	53%	73%	100%
Forklifts	<50	-54%	-21%	26%	90%	96%	100%
	50 - 120	-647%	-22%	32%	90%	90%	100%
	120 - 175	-598%	-21%	38%	82%	90%	100%
Generator Sets	<120	-430%	-11%	11%	89%	91%	100%
	<175	-436%	-11%	0%	81%	89%	100%
Lav Truck	<175	-477%	-21%	1%	84%	90%	100%
Lift	<120	-503%	-22%	9%	90%	89%	100%

Equipment	Horsepower	2015					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	-3040%	-27%	28%	-86%	57%	100%
	15 - 25	-4465%	-32%	32%	-48%	46%	100%
Air Conditioner	<175	-450%	-19%	-41%	47%	85%	100%
Baggage Tug	<120	-590%	-21%	30%	91%	89%	100%
Belt Loader	<120	-541%	-21%	31%	90%	91%	100%
Bobtail	<120	-505%	-19%	65%	89%	96%	100%
Cargo Loader	<120	-720%	-22%	4%	88%	83%	100%
Catering Truck	<250	-1899%	-20%	-54%	16%	72%	100%
Forklifts	<50	-85%	-20%	41%	83%	94%	100%
	50 - 120	-682%	-21%	23%	81%	89%	100%
	120 - 175	-596%	-20%	36%	68%	91%	100%
Generator Sets	<120	-456%	-11%	22%	84%	91%	100%
	<175	-444%	-10%	12%	71%	90%	100%
Lav Truck	<175	-483%	-20%	10%	76%	91%	100%
Lift	<120	-531%	-21%	17%	85%	89%	100%

Equipment	Horsepower	2020					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	-3040%	-27%	28%	-91%	57%	100%
	15 - 25	-4722%	-32%	29%	-91%	39%	100%
Air Conditioner	<175	-449%	-19%	-104%	-81%	88%	100%
Baggage Tug	<120	-621%	-20%	31%	87%	90%	100%
Belt Loader	<120	-569%	-20%	31%	85%	91%	100%
Bobtail	<120	-526%	-19%	53%	84%	95%	100%
Cargo Loader	<120	-757%	-21%	-9%	78%	81%	100%
Catering Truck	<250	-1946%	-20%	-120%	-75%	73%	100%
Forklifts	<50	-100%	-20%	32%	60%	91%	100%
	50 - 120	-696%	-21%	-17%	55%	84%	100%
	120 - 175	-596%	-20%	-12%	31%	89%	100%
Generator Sets	<120	-476%	-10%	25%	69%	91%	100%
	<175	-446%	-10%	5%	48%	90%	100%
Lav Truck	<175	-485%	-19%	-3%	56%	91%	100%
Lift	<120	-553%	-20%	13%	72%	89%	100%

Equipment	Horsepower	2025					
		CO	CO_2e	NOx	PM	ROG	SO_2
Aerial Lifts	<15	-3040%	-27%	28%	-91%	57%	100%
	15 - 25	-4803%	-32%	27%	-109%	37%	100%
Air Conditioner	<175	-450%	-19%	-346%	-331%	88%	100%
Baggage Tug	<120	-640%	-19%	17%	79%	89%	100%
Belt Loader	<120	-587%	-20%	16%	72%	90%	100%
Bobtail	<120	-548%	-19%	32%	72%	93%	100%
Cargo Loader	<120	-763%	-20%	-40%	56%	78%	100%
Catering Truck	<250	-1936%	-20%	-330%	-294%	72%	100%
Forklifts	<50	-106%	-20%	19%	-26%	89%	100%
	50 - 120	-703%	-21%	-69%	-48%	79%	100%
	120 - 175	-597%	-20%	-172%	-110%	83%	100%
Generator Sets	<120	-483%	-10%	13%	37%	90%	100%
	<175	-446%	-10%	-37%	-3%	90%	100%
Lav Truck	<175	-486%	-19%	-57%	5%	90%	100%
Lift	<120	-560%	-20%	-8%	37%	87%	100%

8.1.2 Use Electric and Hybrid Construction Equipment

Range of Effectiveness: 2.5 – 80% of GHG emissions from equipment that is electric or hybrid if used 100% of the time

Measure Description:

When construction equipment is powered by grid electricity rather than fossil fuel, direct GHG emissions from fuel combustion are replaced with indirect GHG emissions associated with the electricity used to power the equipment. When construction equipment is powered by hybrid-electric drives, GHG emissions from fuel combustion are reduced.

Measure Applicability:

- Construction vehicles

Inputs:

The following information needs to be provided by the Project Applicant:

- Electricity provider for the Project
- Fuel type and Horsepower of Construction Equipment
- Hours of operation

Baseline Method:

$$\text{Baseline Emission} = EF \times Hp \times LF \times Hr \times C$$

Where:

Emission = MT CO_2e or MT Criteria Pollutant
EF = Emission factor for the relevant fuel horsepower tier (g/hp-hr). Obtained from OFFROAD2007. See accompanying tables
Hp = Horsepower of equipment.
LF = Load factor of equipment for the relevant horsepower tier (dimensionless). Obtained from OFFROAD2007.
Hr = Hours of operation.
C = Unit conversion factor

Mitigation Method:

<u>Fully Electric Vehicle</u>

Construction vehicles will run solely on electricity. The indirect GHG emission from electricity generation is:

$$\text{Mitigated GHG Emission} = Utility \times Hp \times LF \times Hr \times C$$

Where:

GHG emissions = MT CO_2e
Utility = Carbon intensity of Local Utility (CO_2e/kWh)
Hp = Horsepower of equipment.
LF = Load factor of equipment for the relevant horsepower tier (dimensionless). Obtained from OFFROAD2007.
Hr = Hours of operation.
C = Unit conversion factor

Criteria pollutant emissions will be 100% reduced for equipment running solely on electricity.

$$\text{GHG Reduction }\%^{106} = 1 - \frac{\text{Utility} \times C}{EF \times 10^{-6}}$$

Hybrid-Electric Vehicle

GHG Reduction % = Percent Reduction in Fuel Consumption

Emission Reduction Ranges and Variables:

Fully Electric Vehicle

GHG

Utility	Diesel	Compressed Natural Gas 4-strokes	Gasoline 2-strokes	Gasoline 4-strokes				
				<25 HP	25-50 HP	50-120 HP	120-175 HP	175-500 HP
LADW&P	26.3%	37.9%	2.5%	2.5%	46.5%	45.9%	44.4%	42.8%
PG&E	72.9%	77.1%	64.1%	64.1%	80.3%	80.1%	79.5%	78.9%
SCE	61.8%	67.9%	49.5%	49.5%	72.3%	72.0%	71.2%	70.4%
SDGE	53.5%	60.9%	38.5%	38.5%	66.3%	65.9%	64.9%	63.9%
SMUD	67.0%	72.2%	56.3%	56.3%	76.0%	75.8%	75.1%	74.3%

Criteria pollutant

Emissions will be 100% reduced for equipment running on electricity.

Hybrid-Electric Vehicle

GHG

The Project Applicant has to determine the fuel consumption reduced from using the hybrid-electric vehicle. The emission reductions for all pollutants are the same as the fuel reduction.

[106] This assumes energy from engine losses are the same.

Discussion:

The CO_2 emission factor show in the accompanying tables obtained from OFFROAD2007 [1] shows the same emissions within each horsepower tier regardless of the scenario year or equipment model year. The contributions of CH_4 and N_2O to overall GHG emissions is likely small (< 1% of total CO_2e) from diesel construction equipment [2] and were therefore not included. Therefore, the CO_2e emission reduction is dependent on the electricity provider for the Project, horsepower and fuel of the construction equipment only.

On the other hand, the criteria pollutant emission factors from OFFROAD2007 vary for different scenario and equipment model years. The criteria pollutant emission factors presented in the accompanying tables correspond to those of new equipment in the respective scenario years, i.e., model year is the same as scenario year. Since older equipment have higher emission factors due to deterioration and less regulation, the emission reduction calculated from this methodology is likely to be an underestimate.

Assumptions:

Data based upon the following references:

[1] California Air Resources Board. Off-road Emissions Inventory. OFFROAD2007. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm

[2] California Climate Action Registry (CCAR). 2009. General Reporting Protocol. Version 3.1. Available online at: http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html

[3] California Climate Action Registry Reporting Online Tool. 2006 PUP Reports. Available online at: https://www.climateregistry.org/CARROT/public/reports.aspx

Preferred Literature:

Electric construction equipment is available commercially from companies such as Peterson Pacific Corporation and Komptech USA, which specialize in the mechanical processing equipment like grinders and shredders [4,5]. The amount of direct GHG emissions avoided can be calculated using CARB's OFFROAD2007 model, which provides state-wide and regional emission factors for a variety of construction equipment that can be converted to grams per horsepower-hour [6]. Multiplying this factor by the number of hours of operation gives the direct GHG emissions. Assuming the same number of operating hours as the diesel-powered equipment, the electricity required to run a piece of electric construction equipment can be calculated by multiplying the operating hours by the amperage required to run the equipment and the voltage rating (obtained from manufacturer technical specifications) to obtain total kWh required. Multiplying this value by the carbon-intensity factor of the local utility gives the amount of indirect GHG emissions associated with using the electric equipment. The

GHG emissions reduction associated with this mitigation measure is therefore the difference in emissions from these two scenarios.

Construction equipment powered by hybrid-electric drives is also commercially available from companies such as Caterpillar [7]. For example, Caterpillar reports that during an 8-hour shift, its D7E hybrid dozer burns 19.5% fewer gallons of fuel than a conventional dozer while achieving a 10.3% increase in productivity. The D7E model burns 6.2 gallons per hour compared to a conventional dozer which burns 7.7 gallons per hour. The percent reduction in fuel use is directly proportional to the percent reduction in GHG emissions. Assuming complete combustion to CO_2 and a carbon content of 87%, the CO_2 emissions reductions can be calculated. Fuel usage and savings are dependent on the make and model of the construction equipment used. The Project Applicant should calculate project-specific savings and provide manufacturer specifications indicating fuel burned per hour.

Alternative Literature:

None

Notes:

[4] Peterson Pacific Corp. Product Brochure Downloads. Available online at: http://www.petersonpacific.com/content/MediaGallery_56_v. Accessed March 2010.
[5] Komptech USA. Products. Available online at: http://www.komptech.com/usa/products.htm. Accessed March 2010.
[6] CARB. OFFROAD 2007 Model. Available online at: http://www.arb.ca.gov/msei/offroad/offroad.htm. Accessed February 2010.
[7] Caterpillar. D7E Efficiency. Accessed February 2010. Available online at: http://www.cat.com/D7E

Other Literature Reviewed:

None

Table C-2.1
Emissions Factors from Different Fuels

Fuel	HP	CO_2 Emission Factor (g/hp-hr) All Years
Compressed Natural Gas 4-stroke	All	674.66
Diesel	All	568.30
Gasoline 2-stroke	All	429.44
Gasoline 4-stroke	<25	429.44
	25-50	783.30
	50-120	774.50
	120-175	753.25
	175-500	732.00

Fuel	HP	ROG Emission Factor (g/hp-hr)		
		2004	2010	2015+
Compressed Natural Gas 4-strokes	<15	0.14	0.14	0.14
	15-25	0.14	0.14	0.14
	25-50	0.06	0.01	0.01
	50-120	0.07	0.01	0.01
	120-175	0.06	0.01	0.01
	175-250	0.06	0.01	0.01
	250-500	0.06	0.01	0.01
Diesel	<15	0.57	0.41	0.41
	15-25	0.54	0.48	0.48
	25-50	0.54	0.20	0.08
	50-120	0.38	0.16	0.08
	120-175	0.18	0.13	0.08
	175-250	0.12	0.08	0.06
	250-500	0.10	0.08	0.06
	500-750	0.12	0.08	0.06
	750-1000	0.57	0.08	0.06
	>1000	0.57	0.08	0.08
Gasoline 2-stroke	<2	6.70	5.52	5.52
	2-15	4.19	3.59	3.59
	15-25	4.07	3.79	3.79
Gasoline 4-stroke	<5	6.70	5.52	5.52
	5-15	4.19	3.59	3.59
	15-25	4.07	3.79	3.79

Fuel	HP	ROG Emission Factor (g/hp-hr)		
		2004	2010	2015+
	25-50	1.49	0.65	0.65
	50-120	0.91	0.24	0.24
	120-175	0.72	0.15	0.15
	175-250	0.72	0.15	0.15
	250-500	0.72	0.15	0.15

Fuel	HP	CO Emission Factor (g/hp-hr)		
		2004	2010	2015+
Compressed Natural Gas 4-strokes	<15	300	300	300
	15-25	300	300	300
	25-50	7.02	7.02	7.02
	50-120	20	20	20
	120-175	16	16	16
	175-250	16	16	16
	250-500	16	16	16
Diesel	<15	3.47	3.47	3.47
	15-25	2.34	2.34	2.34
	25-50	3.27	2.86	2.72
	50-120	3.23	3.09	3.05
	120-175	2.70	2.70	2.70
	175-250	0.92	0.92	0.92
	250-500	0.92	0.92	0.92
	500-750	0.92	0.92	0.92
	750-1000	2.70	0.92	0.92
	>1000	2.70	0.92	0.92
Gasoline 2-stroke	<2	318	236	236
	2-15	274	225	225
	15-25	284	238	238
Gasoline 4-stroke	<5	318	236	236
	5-15	274	225	225
	15-25	284	238	238
	25-50	71	38	38
	50-120	38	8.76	8.76
	120-175	21	21	21
	175-250	21	21	21
	250-500	21	21	21

Fuel	HP	NOx Emission Factor (g/hp-hr)		
		2004	2010	2015+
Compressed Natural Gas 4-strokes	<15	8.44	8.44	8.44
	15-25	8.44	8.44	8.44
	25-50	5.19	1.95	1.95
	50-120	4.57	1.58	1.58
	120-175	4.56	1.58	1.58
	175-250	4.56	1.58	1.58
	250-500	4.56	1.58	1.58
Diesel	<15	6.08	4.37	4.37
	15-25	5.79	4.57	4.57
	25-50	5.10	4.88	4.80
	50-120	5.64	5.01	2.53
	120-175	4.72	4.44	2.27
	175-250	4.58	2.45	1.36
	250-500	4.29	2.45	1.36
	500-750	4.51	2.45	1.36
	750-1000	8.17	4.08	2.36
	>1000	8.17	4.08	2.36
Gasoline 2-stroke	<2	2.32	2.70	2.70
	2-15	2.84	2.90	2.90
	15-25	2.32	2.68	2.68
Gasoline 4-stroke	<5	2.32	2.70	2.70
	5-15	2.84	2.90	2.90
	15-25	2.32	2.68	2.68
	25-50	4.52	1.33	1.33
	50-120	5.06	1.78	1.78
	120-175	4.98	1.94	1.94
	175-250	4.98	1.94	1.94
	250-500	4.98	1.94	1.94

Fuel	HP	PM Emission Factor (g/hp-hr)		
		2004	2010	2015+
Compressed Natural Gas 4-strokes	<15	0.90	0.90	0.90
	15-25	0.90	0.90	0.90
	25-50	0.06	0.06	0.06
	50-120	0.06	0.06	0.06
	120-175	0.06	0.06	0.06
	175-250	0.06	0.06	0.06
	250-500	0.06	0.06	0.06
Diesel	<15	0.47	0.38	0.38
	15-25	0.38	0.38	0.38
	25-50	0.43	0.35	0.16
	50-120	0.39	0.24	0.01
	120-175	0.19	0.16	0.01
	175-250	0.11	0.11	0.01
	250-500	0.11	0.11	0.01
	500-750	0.11	0.11	0.01
	750-1000	0.38	0.11	0.06
	>1000	0.38	0.11	0.06
Gasoline 2-stroke	<2	0.74	0.74	0.74
	2-15	0.14	0.14	0.14
	15-25	0.14	0.14	0.14
Gasoline 4-stroke	<5	0.74	0.74	0.74
	5-15	0.14	0.14	0.14
	15-25	0.14	0.14	0.14
	25-50	0.06	0.06	0.06
	50-120	0.06	0.06	0.06
	120-175	0.06	0.06	0.06
	175-250	0.06	0.06	0.06
	250-500	0.06	0.06	0.06

8.1.3 Limit Construction Equipment Idling beyond Regulation Requirements

Range of Effectiveness: Varies with the amount of Project Idling occurring and the amount reduced.

Measure Description:

Heavy duty vehicles will idle during loading/unloading and during layovers or rest periods with the engine still on. Idling requires fuel use and results in emissions. The California Air Resources Board (CARB) Heavy-Duty Vehicle Idling Emission Reduction Program limits diesel-fueled commercial motor vehicles idling time to 5 minutes. There are some exceptions to the regulation such as positioning or providing a power source for equipment or operations such as lift, crane, pump, drill, hoist or other auxiliary equipment. Reduction in idling time beyond required under the regulation would further reduce fuel consumption and thus emissions. The project applicant should develop an enforceable mechanism that monitors the idling time to ensure compliance with this mitigation measure.

Measure Applicability:

- Heavy Duty Commercial Vehicles

Inputs:

The following information needs to be provided by the Project Applicant:

- Idling time of vehicle

Baseline Method:

For all pollutants, the idling emission from each idling period is calculated as follows:

$$\text{Emission} = EF \times t \times C$$

Where:

Emission = grams of pollutant per idling period

EF = Idling emission factor for diesel-fueled heavy duty vehicles obtained from EMFAC (g/idling-hour).

t = Baseline idling period (minute). This is 5 minutes for all vehicles which do not have auxiliary equipment powered by the primary engine exempted from the regulation. For exempted vehicles, the Project applicant shall determine the baseline idling period.

C = Time conversion factor = 1/60

Mitigation Method:

Mitigated emissions for this measure are calculated using the same method as baseline method, but with mitigated idling period.

Emission Reduction Ranges and Variables:

Emission reduction is calculated as follows:

$$\text{Reduction} = 1 - \frac{t_M}{t_B}$$

Where:

t_M = mitigated idling period
t_B = baseline idling period

Discussion:

If a heavy duty truck is regulated under the CARB Idling Emission Reduction Program, and the Project Applicant has committed to enforce a reduced idling period to 3 minutes, then the emissions for all pollutants from idling emissions would be reduced by:

$$1 - \frac{3}{5} = 0.4 = 40\%$$

If the Project Applicant determines that the average idling period for a heavy duty vehicle with a hoist powered by the primary engine is 20 minutes, and has committed to enforce a reduced idling time to 15 minutes, then the emissions for all pollutants would be reduced by:

$$1 - \frac{15}{20} = 0.25 = 25\%$$

Assumptions:

Data based upon the following references:

- California Air Resources Board (CARB) 2009. Heavy-Duty Vehicle Idling Emission Reduction Program. Available at: http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm
- CARB 2010. EMFAC2007 Model. Available at: http://www.arb.ca.gov/msei/onroad/latest_version.htm

Preferred Literature:

Idling of heavy duty commercial vehicles requires fuel use and results in emissions. Project Applicant can obtain the average idling emission factor for diesel-fueled heavy duty trucks in the county where the Project would be located from EMFAC. The total idling emissions can be determined by multiplying this emission factor by the total idling period. The California Air Resources Board (CARB) Heavy-Duty Vehicle Idling Emission Reduction Program limits diesel-fueled commercial motor vehicles idling time to 5 minutes, with exceptions for some vehicles with auxiliary equipment powered by the primary engine [1]. The Project Applicant has to determine the appropriate baseline idling periods for such exempted vehicles. A plan should also be developed to ensure enforcement of the reduced idling period that the Project Applicant has committed to.

Alternative Literature:

None

Notes:

[1] California Air Resources Board (CARB) 2009. Heavy-Duty Vehicle Idling Emission Reduction Program. Available at: http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm

Other Literature Reviewed:

None

8.1.4 Institute a Heavy-Duty Off-Road Vehicle Plan

Range of Effectiveness:

Not applicable on its own. This measure ensures compliances with other mitigation measures.

Measure Description:

The Project Applicant should provide a detailed plan that discusses a construction vehicle inventory tracking system to ensure compliances with construction mitigation measures. The system should include strategies such as requiring hour meters on equipment, documenting the serial number, horsepower, manufacture age, fuel, etc. of all onsite equipment and daily logging of the operating hours of the equipment.

Measure Applicability:

- This measure ensures compliances with other mitigation measures.
- Construction vehicles.

Preferred Literature:

None

Alternative Literature:

None

Literature References:

None

8.1.5 Implement a Construction Vehicle Inventory Tracking System

Range of Effectiveness:

Not applicable on its own. This measure ensures compliances with other mitigation measures.

Measure Description:

The Project Applicant should provide a detailed plan that discusses a construction vehicle inventory tracking system to ensure compliances with construction mitigation measures. The system should include strategies such as requiring engine run time meters on equipment, documenting the serial number, horsepower, manufacture age, fuel, etc. of all onsite equipment and daily logging of the operating hours of the equipment.

Measure Applicability:

- This measure ensures compliance with other mitigation measures.
- Construction vehicles.

Preferred Literature:

None

Alternative Literature:

None

Literature References:

None

9.0 Miscellaneous

9.1 Miscellaneous

9.1.1 Establish a Carbon Sequestration Project

Range of Effectiveness: Varies depending on Project Applicant and projects selected. The GHG emissions reduction is subtracted from the overall baseline project emissions inventory.

Measure Description:
The Project Applicant would establish a carbon sequestration project. This might include (a) geologic sequestration or carbon capture and storage techniques in which CO_2 from point sources such as power plants and fuel processing plants is captured and injected underground, (b) terrestrial sequestration in which ecosystems such as wetlands and forestlands are established or preserved to serve as CO_2 sinks, (c) novel techniques involving advanced chemical or biological pathways, or (d) technologies yet to be discovered. The Project Applicant would commit to a desired amount of carbon sequestration in MT per year. This amount would be subtracted from the overall baseline project emissions inventory. In order to take credit for this measure, the Project Applicant should be required to establish a reporting and verification mechanism to quantify the amount of carbon sequestered. Furthermore, the Project Applicant should be required to prove additionality.[107]

Measure Applicability:
- Overall baseline project GHG emissions inventory

Inputs:
- Amount of CO_2e sequestered (MT/year)

Baseline Method:
The Project Applicant should calculate the baseline project emissions inventory ($CO_2e_{baseline}$, the total baseline CO_2e emissions in MT per year) using the methods described in the baseline methodology document.

Mitigation Method:
The amount of CO_2e sequestered is subtracted from the overall project emissions inventory. Therefore, the percent GHG reduction is

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[107] Additionality is the reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of the Project. In other words, the Project should not subsidize or take credit for emissions reductions which would have occurred regardless of the Project.

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Misc-1

Carbon Sequestration

GHG emission reduction $= \dfrac{CO_2e_{sequestered}}{CO_2e_{baseline}}$

Where:

GHG emission reduction	=	Percentage reduction in overall GHG emissions from carbon sequestration project
$CO_2e_{sequestered}$	=	Amount of CO_2e sequestered (MT/year) Provided by Applicant
$CO_2e_{baseline}$	=	Total baseline CO_2e emissions (MT/year)

Assumptions:
Data based upon the following references:

- USDOE. Fossil Energy: Carbon Sequestration. Available online at: http://www.fossil.energy.gov/programs/sequestration/

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	To be determined by Applicant
All other pollutants	None

Preferred Literature:
The DOE Fossil Energy – Carbon Sequestration website describes the four core carbon sequestration technologies: geologic, carbon capture and storage, terrestrial, and novel biological and chemical pathways. The DOE website discusses current challenges and research projects associated with each of the carbon sequestration technologies, as well as the trade-offs between local environmental impacts and global environmental benefits.

Alternative Literature:
None

Other Literature Reviewed:
None

9.1.2 Establish Off-Site Mitigation

Range of Effectiveness: Varies depending on Project Applicant and projects selected. The GHG emissions reduction is subtracted from the overall baseline project emissions inventory.

Measure Description:
The Project Applicant may decide to establish GHG reduction measures similar to any of the measures discussed in this report. These reductions would take place outside of the Project Site. In order to take credit for this measure, the Project Applicant should be required to establish a method for registering and verifying the GHG emissions reduction. Furthermore, the Project Applicant should be required to prove additionality.[108]

Measure Applicability:
- Overall baseline project GHG emissions inventory

Inputs:
- Amount of CO_2e reduced off-site (MT/year)

Baseline Method:
The Project Applicant should calculate the baseline project emissions inventory ($CO_2e_{baseline}$, the total baseline CO_2e emissions in MT per year) using the methods described in the baseline methodology document.

Mitigation Method:
The amount of CO_2e reduced off-site is subtracted from the overall project emissions inventory. Therefore, the percent GHG reduction is:

$$\text{GHG emission reduction} = \frac{CO_2e_{\text{reduced off-site}}}{CO_2e_{\text{baseline}}}$$

Where:

GHG emission reduction	=	Percentage reduction in overall GHG emissions from off-site mitigation
$CO_2e_{\text{reduced off-site}}$	=	Amount of CO_2e reduced off-site (MT/year) Provided by Applicant
CO_2e_{baseline}	=	Total baseline CO_2e emissions (MT/year)

[108] Additionality is the reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of the Project. In other words, the Project should not subsidize or take credit for emissions reductions which would have occurred regardless of the Project.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	To be determined by Applicant
All other pollutants	To be determined by Applicant. Reductions in criteria pollutant emissions may be achieved if the off-site mitigation involves removing or retrofitting combustion sources or reducing electricity use.[109]

Preferred Literature:

None

[109] Note that the reduction in criteria pollutant emissions may not occur in the same air basin as the project.

9.1.3 Use Local and Sustainable Building Materials

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:
Using building materials which are sourced and processed locally (i.e. close to the project site, as opposed to in another state or country) reduces transportation distances and therefore reduces GHG emissions from fuel combustion. Using sustainable building materials, such as recycled concrete or sustainably harvested wood, also contributes to GHG emissions reductions due to the less carbon-intensive nature of the production and harvesting of these materials. Unlike measures which reduce GHG emissions during the operational lifetime of a project, such as reducing building electricity and water usage, these mitigation efforts are realized prior to the actual operational lifetime of a project. Therefore, these GHG emissions are best quantified in terms of a life-cycle analysis. Life cycle analyses examine all stages of the life of a product, including raw material acquisition, manufacture, transportation, installation, use, and disposal or recycling. The Project Applicant should seek local agency guidance on comparing and/or combining operational emissions inventories and life cycle emissions inventories.

Measure Applicability:
- Life cycle emissions from building materials

Inputs:
The following information needs to be provided by the Project Applicant:
- Project location
- Material transport distance
- Material type
- Building assembly type and square footage

Preferred Literature:
Several software packages and web-based tools are available which can be used to quantify the life cycle emissions from building materials.

The Building for Environmental and Economic Sustainability (BEES) software developed by the National Institute of Standards and Technology (NIST) can calculate global warming potential (in terms of CO_2 emissions in grams per product) for a variety of building products, including a multitude of cement varieties, fabrics, tiles, glass, wood, and shelving materials. Required inputs are the type of building material (e.g. generic 100% Portland cement, generic 20% limestone cement), and transportation distance. The user can compare between different types of materials and associated transportation distances.

The BEES software and user manual is available for public download here:
http://www.bfrl.nist.gov/oae/software/bees/bees.html

The Athena EcoCalculator for Assemblies software developed by the Athena Institute analyzes the environmental impacts of whole buildings in terms of global warming potential (in terms of CO_2e) from raw material extraction, final material manufacturing, transportation, on-site construction, maintenance, and demolition and disposal. Required inputs include the project location, assembly type (columns and beams, floor, exterior wall, interior wall, window, or roof), type of material, and square footage of material. The Athena EcoCalculator compares CO_2e emissions from the project-specific assembly to default assemblies of similar material and size. The Athena EcoCalculator is based on the more rigorous Athena Impact Estimator software, which requires detailed information about the building design including the number of columns and beams, supported span, wall height, and type of material used for all aspects. In contrast, the Athena EcoCalculator assumes default values for many of the architectural details.

A free public version of the Athena EcoCalculator is available for download here:
http://www.athenasmi.org/tools/ecoCalculator/index.html

Alternative Literature:
None

Other Literature Reviewed:
None

9.1.4 Require Best Management Practices in Agriculture and Animal Operations

9.1.5 Require Environmentally Responsible Purchasing

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:
Requiring environmentally responsible purchasing has the potential to have a net effect of reducing GHG emissions by reducing the life cycle emissions, operating emissions, and/or transportation emissions associated with a product. Examples of environmentally responsible purchases which reduce life cycle emissions include but are not limited to: purchasing products with sustainable packaging; purchasing post-consumer recycled copier paper, paper towels, and stationary; purchasing and stocking communal kitchens with reusable dishes and utensils; choosing sustainable cleaning supplies; and leasing equipment from manufacturers who will recycle the components at their "end of life." Examples of environmentally responsible purchases which reduce a Project's operating emissions include choosing ENERGY STAR appliances and Water Sense-certified water fixtures; choosing electronic appliances with built in sleep-mode timers; and purchasing "green power" (e.g. electricity generated from renewables or hydropower) from the utility. Choosing locally-made and distributed products reduces the transportation distances required to move the product from the distribution or manufacturing center to the Project, and therefore reduce GHG emissions associated with the transportation vehicles.

Since the magnitude of the energy and GHG reduction depends on the purchasing strategies implemented, the expected GHG reduction is not quantifiable at this time. Therefore, this mitigation measure should be incorporated as a Best Management Practice to encourage homeowners, commercial space tenants, and builders to make sustainable purchases and therefore reduce their contribution to GHG emissions. The Project Applicant could take quantitative credit for this mitigation measure if detailed and substantial evidence were provided.

Measure Applicability:
- Purchase of consumer and business goods and appliances

Assumptions:
Data based upon the following references:

- City of Chicago and ICLEI. Chicago Green Office Challenge: Waste. Available online at: http://www.chicagogreenofficechallenge.org/pages/waste/50.php
- Cool California.org. Small Business Money Saving Actions: Recycle and Cut Waste. Available online at: http://www.coolcalifornia.org/article/recycle-and-cut-waste

- Flex Your Power.org. Commercial Overview Energy Saving Tips: Office Equipment Tips. Available online at: http://www.fypower.org/com/tools/energy_tips_results.html?tips=office
- ENERGY STAR. 2007. Putting Energy into Profits: ENERGY STAR Guide for Small Businesses. Available online at: http://www.energystar.gov/ia/business/small_business/sb_guidebook/smallbizguide.pdf

Emission Reduction Ranges and Variables:
This is a Best Management Practice and therefore at this time there is no quantifiable reduction. Check with local agencies for guidance on any allowed reductions associated with implementation of best management practices.

Preferred Literature:
The Chicago Green Office Challenge, Cool California.org, and Flex Your Power.org website resources provide many examples of office and small business purchasing strategies which reduce waste and energy use. The ENERGY STAR Guide provides more details about energy-efficient appliance choices and the option to purchase renewable or clean energy from the utility for a higher cost.

Alternative Literature:
None

Other Literature Reviewed:
None

9.1.6 Implement an Innovative Strategy for GHG Mitigation

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. The GHG emissions reduction may be quantifiable. If not quantifiable, this mitigation measure should be implemented as a Best Management Practice.

Measure Description:
The Project Applicant may develop a novel strategy to reduce GHG emissions at the project site or off-site. This strategy may incorporate technologies which have yet to be developed at the time of the publication of this report. In order to take quantifiable credit for this measure, the Project Applicant must provide detailed and substantial evidence showing the quantification and verification of the GHG emissions reduction. If the GHG emissions reduction is not quantifiable, it should be implemented as a Best Management Practice.

Measure Applicability:

- To be determined by Project Applicant

Inputs:

- Amount of CO_2e reduced due to Innovative Strategy
- Baseline CO_2e for applicable inventory sector

Baseline Method:
The Project Applicant should calculate the baseline CO_2e emissions associated with the applicable GHG emissions inventory sector ($CO_2e_{baseline\text{-}sector}$, the baseline CO_2e emissions in MT per year for the applicable sector) using the methods described in the baseline methodology document. For example, if the Innovative Strategy achieves GHG reductions by reducing building energy use, $CO_2e_{baseline\text{-}sector}$ is the total CO_2e emissions associated with baseline building energy use.

Mitigation Method:
The amount of CO_2e reduced due to the Innovative Strategy is subtracted from applicable emissions inventory sector. Therefore, the percent GHG reduction is:

$$\text{GHG emission reduction} = \frac{CO_2e_{reduced\text{-}sector}}{CO_2e_{baseline\text{-}sector}}$$

Where:

GHG emission reduction	=	Percentage reduction in sector GHG emissions due to Innovative Strategy
$CO_2e_{reduced\text{-}sector}$	=	Amount of CO_2e reduced due to Innovative Strategy (MT/year) Provided by Applicant
$CO_2e_{baseline\text{-}sector}$	=	Baseline sector CO_2e emissions (MT/year)

If the GHG emissions reduction cannot be quantified and/or verified, check with local agencies for guidance on any allowed reductions associated with implementation of Best Management Practices.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	To be determined by Applicant
All other pollutants	None

Preferred Literature:
None

10.0 General Plans

In addition to fact sheets and BMPs, this document includes measures that are more applicable for General Plans. The following measures have substantial evidence of reductions when implemented at a General Plan level rather than a project level.

10.1 General Plans

10.1.1 Fund Incentives for Energy Efficiency

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:
By funding incentives for energy-efficient choices in equipment, fixtures in buildings, or energy sources, a Project Applicant can promote reductions in GHG emissions associated with fuel combustion and electricity use. The Project Applicant may choose to contribute to an existing municipal energy fund or establish a new energy fund for the Project. The Project Applicant should check with the local air district regarding participating in established programs. These energy funds may provide financial incentives or grants for any number of energy efficiency measures including but not limited to: retrofitting or designing new buildings, parking lots, streets, and public areas with energy-efficient lighting; retrofitting or designing new buildings with low-flow water fixtures and high-efficiency appliances; retrofitting or purchasing new low-emissions equipment; purchasing electric or hybrid vehicles; and investing in renewable energy systems such as photovoltaics or wind turbines. Recipients of energy fund grants could include neighborhood developers, home and commercial space builders, homeowners, and utilities. Energy funds allow recipients flexibility in choosing efficiency strategies while still achieving the desired effects of reduced energy use and associated GHG emissions.

Since the magnitude of the energy and GHG reduction depends on the strategies selected by the energy fund recipients, the expected GHG reduction is not quantifiable at this time. Therefore, this mitigation measure should be incorporated as a Best Management Practice to encourage utilities, builders, residents, and commercial tenants to reduce their energy use and/or choose cleaner energy, and therefore reduce their contribution to GHG emissions. The Project Applicant could take quantitative credit for this mitigation measure if detailed and substantial evidence were provided.

Measure Applicability:
- GHG emissions from energy use (fuel combustion and electricity use)

Assumptions:
Data based upon the following references:

- City of Ann Arbor. Energy Office: Energy Fund. Available online at: http://www.a2gov.org/government/publicservices/systems_planning/energy/Pages/EnergyFund.aspx
- Go Solar California. California Solar Initiative. Available online at: http://www.gosolarcalifornia.org/csi/index.html
- USDOE. Database of State Initiatives for Renewables and Efficiency: California. Available online at: http://www.dsireusa.org/incentives/index.cfm?re=1&ee=1&spv=0&st=0&srp=1&state=CA
- California Clean Energy Fund. About Us. Available online at: http://www.calcef.org/about.htm

Emission Reduction Ranges and Variables:
This is a Best Management Practice and therefore there is no quantifiable reduction at this time. Check with local agencies for guidance on any allowed reductions associated with implementation of best management practices.

Preferred Literature:
The City of Ann Arbor's Energy Fund provides a good example of a municipal general energy fund which provides grants for a wide variety of energy efficiency and renewable energy investments. The California Solar Initiative and the Energy Efficient Appliance Rebate Program (found on the DOE Database of State Initiatives for Renewables and Efficiency) are examples of California state energy funds which incentivize specific types of purchases. The DOE database provides a listing of many more California municipal and local programs.

Alternative Literature:

None

Other Literature Reviewed:

- The Energy Foundation. Programs: Power. Available online at: http://www.ef.org/programs.cfm

10.1.2 Establish a Local Farmer's Market

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:

Establishing a local farmer's market has the potential to reduce greenhouse gas emissions by providing project residents with a more local source of food, potentially resulting in a reduction in the number of trips and vehicle miles traveled by both the food and the consumers to grocery stores and supermarkets. If the food sold at the local farmer's market is produced organically, it can also contribute to greenhouse gas reductions by displacing carbon-intensive food production practices. As discussed in more detail below, these emissions reductions cannot be reasonably quantified at this time because they are based on several undefined parameters: the relative locations of the farmer's market, supermarket, and supermarket produce suppliers; the carbon intensity of food production practices; and the role of the farmer's market in a development, such as whether it supplements trips to the grocery store or completely displaces them.

Measure Applicability:

- Number of trips to supermarket and vehicle miles traveled
- Life cycle emissions of food production

Discussion:

Potential greenhouse gas emissions from establishing a local farmer's market can be divided into two types: emissions reductions from transportation and emissions reductions from food production practices. The transportation of food from a field to a store and the transportation of consumers from their homes to a store both contribute to greenhouse gas emissions. In many cases, especially in urban areas, a local farmer's market will reduce emissions associated with the distribution of food from the field to the consumer, since the farms represented at the local farmer's market are theoretically closer to the consumer than the farms which produce most of the food found at supermarkets and grocery stores. However, California has a large number of farms and orchards and in some cases the farms represented at a local farmer's market may not be different than those represented at the neighborhood grocery store. If a consumer obtains produce from a local farmer's market when they would otherwise drive a farther distance to purchase produce from a grocery store, the trip to the grocery stores is displaced, VMT is reduced, and GHG emissions reductions are achieved. However, if a consumer drives to the farmer's market and then to the grocery store (for example, to purchase food which the farmer's market cannot provide), the trip to the farmer's market is made in addition to the trip to the grocery store. Thus, an additional trip is made, VMT is added, and greenhouse gas emissions are actually increased. It is unclear how local farmer's markets affect the food purchasing behavior of consumers, and therefore the effect of a farmer's market on transportation greenhouse gas emissions is not quantifiable at this time. The carbon intensity of food production practices also contributes to greenhouse gas emissions; however, these emissions are accounted for in the life cycle analysis of the food and cannot be directly compared to a development's operational greenhouse gas emissions inventory (such as the transportation emissions detailed above). If food at a local farmer's market is produced organically, it is likely that less carbon-intensive practices were used than at the large-scale farms and orchards which produce most food found at grocery stores and supermarkets. Examples of carbon-intensive gardening practices include heated greenhouses and the heavy use of fertilizers and pesticides derived from fossil fuels. Local farms which do not practice organic or sustainable farming may employ these more carbon-intensive practices. Thus, the magnitude of the life-cycle greenhouse gas emissions is difficult to quantify and compare to operational inventories.

Preferred Literature:

None

10.1.3 Establish Community Gardens

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.

Measure Description:

Establishing a community garden has the potential to reduce greenhouse gas emissions by providing project residents with a local source of food, potentially resulting in a reduction in the number of trips and vehicle miles traveled by both the food and the consumers to grocery stores and supermarkets. Community gardens can also contribute to greenhouse gas reductions by displacing carbon-intensive food production practices. As discussed in more detail below, these emissions reductions cannot be reasonably quantified at this time because they are based on several undefined parameters: the relative locations of the community garden, supermarket, and supermarket produce suppliers; the carbon intensity of gardening and farming practices; and the role of a community garden in a development, such as whether it supplements trips to the grocery store or completely displaces them.

Measure Applicability:

- Number of trips to supermarket and vehicle miles traveled
- Life cycle emissions of food production

Discussion:

Potential greenhouse gas emissions from establishing a community garden can be divided into two types: emissions reductions from transportation and emissions reductions from food production practices. The transportation of food from a field to a store and the transportation of consumers from their homes to a store both contribute to greenhouse gas emissions. In most cases a community garden will reduce emissions associated with the distribution of food from the field to the consumer, since with community gardens the food goes directly from the field to the consumer, while in grocery stores and supermarkets the path is more likely field to regional distribution center to store to consumer. If a consumer obtains produce from a community garden when they would otherwise drive a farther distance to purchase produce from a grocery store, the trip to the grocery stores is displaced, VMT is reduced, and GHG emissions reductions are achieved. However, if a consumer drives to the community garden and then to the grocery store (for example, to purchase food which the community garden cannot provide), the trip to the community garden is made in addition to the trip to the grocery store. Thus, an additional trip is made, VMT is added, and greenhouse gas emissions are actually increased. Furthermore, if community gardens displace backyard gardens, they increase transportation emissions. It is unclear how community gardens affect the food purchasing behavior of consumers, and therefore the effect of a community garden on transportation greenhouse gas emissions is not quantifiable at this time. The carbon intensity of food production practices also contributes to greenhouse gas emissions; however, these emissions are accounted for in the life cycle analysis of the food and cannot be directly compared to a development's operational greenhouse gas emissions inventory (such as the transportation emissions detailed above). Community gardens are likely to produce food using less carbon-intensive practices than the large-scale farms and orchards which produce most food found at grocery stores and supermarkets. Examples of carbon-intensive gardening practices include heated greenhouses and the heavy use of fertilizers and pesticides derived from fossil fuels; these practices are not likely to be used at community gardens. Although these qualitative conclusions can be drawn, the magnitude of the life-cycle greenhouse gas emissions is difficult to quantify and compare to operational inventories.

Preferred Literature:

None

10.1.4 Plant Urban Shade Trees

Range of Effectiveness: The reduction in GHG emissions is not quantifiable at this time, therefore this mitigation measure should be implemented as a Best Management Practice. If the study data were updated to account for Title 24 standards, the GHG emissions reductions could be quantified but would vary based on location, building type, and building size.

Measure Description:

Planting shade trees around buildings has been shown to effectively lower the electricity cooling demand of buildings by blocking incident sunlight and reducing heat gain through windows, walls, and roofs. Deciduous trees with large canopies are a desirable choice of shade tree because they provide shade in the warm months and shed their leaves in the winter months to allow sunlight to pass through and warm the building. By reducing cooling demand, shade trees help reduce electricity demand from the local utility and therefore reduce GHG emissions which would otherwise be emitted during the production of that electricity.

A study entitled "Calculating energy-saving potentials of heat-island reduction strategies" conducted by the Lawrence Berkeley National Laboratory (LBNL) Heat Island Group provides a method to quantify reductions in electricity use from planting shade trees around residences, offices, and retail stores. The electricity reductions are based on the LBNL model which assumes 4 shade trees are planted around residences, 8 trees are planted around offices, and 10 trees are planted around retail stores. The LBNL model is also based on electricity use data for two building stocks: Pre-1980 buildings (buildings constructed prior to 1980) and 1980+ buildings (buildings constructed on or after 1980). Other assumptions, including the geometry of the modeled trees and sunlight transmittance, are detailed in Section 2.5 of the study. This mitigation measure describes how to estimate greenhouse gas emissions reductions from planting shade trees based on the LBNL data. Since the model is based on electricity data for Pre-1980 and 1980+ buildings[110] it does not incorporate electricity use improvements due to the California 2001, 2005, or 2008 Title 24 measures. Given that buildings constructed in 2001 or later incorporate Title 24 electricity efficiency improvements, the electricity savings reported in the LBNL study are overestimates of the savings that would actually be achieved for these newer buildings.[111]

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[110] This data for these buildings is based on U.S. Department of Energy and California Energy Commission studies conducted in 1987 through 2001.
[111] The CEC 2003 Impact Analysis Report estimates a state-average 14.9%-26% savings in electricity use for cooling in residential buildings and 6.7% savings in electricity use for cooling in non-residential

While the electricity savings in the study overestimates savings for newer buildings, the data does show that electricity savings (and associated greenhouse gas emissions savings) from planting shade trees are real. A follow-up study which uses similar methodologies with models updated with the Title 24 standards would provide data which could be used to more accurately quantify electricity savings for new buildings.

Measure Applicability:

- Electricity use
- Limitation: It takes several years for trees to grow to the height necessary to provide shade to a building. Furthermore, without deed restrictions, the presence of shade trees around a building may not be permanent, as a new owner may decide to remove the trees or not replace them if they die.

Inputs:

The following information needs to be provided by the Project Applicant:

- Type of building (residential, office, or retail store)
- Square footage of roof
- Heating Degree Days (HDD) or Cooling Degree Days (CDD) of Project location

Baseline Method:

The CEC Residential Appliance Saturation Survey (RASS) and California Commercial Energy Use Survey (CEUS) datasets can be used to calculate the baseline electricity for building cooling. The data is available for different climate zones in California and electricity use from cooling alone can be extracted. The methodology for using RASS and CEUS to calculate $GHG_{baseline}$ is described in the baseline document.

Mitigation Method:

The electricity savings from reduced cooling demand are based on the location of the building. Table 4 of the LBNL study provides a list of cities and their HDD and CDD values. If a project's location is not listed, the Project Applicant should choose a representative city with climate similar to that of the project. Alternatively, the Project Applicant could determine the HDD and CDD of the project location from local meteorological data.

buildings due to the 2005 update to the 2001 Title 24 standards. The CEC 2007 Impact Analysis Report estimates a state-average 19.7%-22.7% savings in overall electricity use for residential buildings and a 8.3% savings in electricity use for cooling in non-residential buildings due to the 2008 update to the 2005 Title 24 standards.

Tables 6 through 16 of the LBNL study show the expected electricity savings (in kWh per 1000 sqft of roof) based on the following parameters:

- Building type (residential, office, or retail store)
- Climate method (HDD or CDD – either can be used)
- Heating method (Gas heated-buildings or electric-heated buildings)

The Project Applicant should select data based on the appropriate parameters above. The entry corresponding to the "Shade tree savings" row and "1980+" column will provide the electricity savings in kWh per 1000 sqft of roof for the specified building type, climate method, and heating method. Note that value is an overestimate of savings for buildings which were manufactured under Title 24 standards.

Then the reduction in GHG emissions is calculated as follows:

$$GHG_{reduction} \quad = \quad SF \times ElecSavings \times Utility$$

Where
$GHG_{reduction}$ = Reduction in GHG emissions from planting shade trees (MT)
SF = Sqft of roof
Provided by Applicant
ElecSavings = Electricity savings (kWh / sqft roof)
From Tables 6 through 16 of LBNL study
Utility = Carbon intensity of local utility (MT CO_2e / kWh)
From Table below

Power Utility	Carbon-Intensity (lbs CO_2e/MWh)
LADW&P	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

Therefore:

$$\text{Percent reduction in GHG emissions} \quad = \quad GHG_{reduction} / GHG_{baseline}$$

Since the Utility term is a factor of both $GHG_{reduction}$ and $GHG_{baseline}$, the percent reduction in GHG emissions does not depend on the value of Utility.

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Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	The following emissions reductions reflect the implementation of three heat island reduction strategies (installing reflective roofs, planting shade trees, and using high-albedo pavements) for the 1980+ stock buildings. The reduction from planting shade trees around new buildings is expected to be smaller than the estimate below. Additionally, savings are expected to be smaller for new buildings due to the Title 24 standards. • 20% for residential buildings • 5-12% for office buildings • 10-17% for retail buildings
All other pollutants	Same as above[112]

Assumptions:

Data based upon the following reference:

- H. Akbari, S. Konopacki. Lawrence Berkeley National Laboratory. 2005. Calculating Energy-Saving-Potentials of Heat-Island Reduction Strategies. Journal of Energy Policy. Volume 33, p. 721-756.

Preferred Literature:

The LBNL study conducted by Akbari and Konopacki of the Heat Island Group modeled energy savings from shade trees for residential, office, and retail building types. The model accounted for differences in climate by modeling in a range of heating-degree-days and cooling-degree days, and compared a basecase (building with no external shading) to a mitigated case (building with 4, 8, and 10 shade trees, depending on the building type). However, the study is based on pre-2001 data and does not account for updates to California's Title 24 standards. Furthermore, the model assumes a specific number of shade trees planted at specific orientations.

Alternative Literature:

- CCAR. 2010. Urban Forest Project Protocol Version 1.1. Available online at: http://www.climateactionreserve.org/how/protocols/adopted/urban-forest/current-urban-forest-project-protocol/

Section D.3 of the protocol describes a method to quantify the reductions in cooling and heating demand due to the planting of shade trees. Computer simulations incorporating

[112] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

building, climate, and shading effects were used to calculate the change in unit energy consumption (UEC) on a per tree basis. Total change in energy use is calculated by multiplying the change in UEC per try by the total number of trees. Buildings were modeled in three stocks with similar building characteristics: buildings constructed prior to 1950, buildings constructed between 1950 and 1980, and buildings constructed after 1980. As with the primary reference above, the data does not account for electricity efficiency improvements due to California's Title 24 standards.

Other Literature Reviewed:

- E. G. McPherson, J. R. Simpson. USDA Forest Service. 2003. Potential Energy Savings in Buildings by an Urban Tree Planting Programme in California. Journal of Urban Forestry & Urban Greening. Volume 2, p. 73-86.
- H. Akbari. Lawrence Berkeley National Laboratory. 2002. Shade Trees Reduce Building Energy Use and CO_2 Emissions from Power Plants. Journal of Environmental Pollution. Volume 116, p. 119-126.
- J. R. Simpson. Department of Environmental Horticulture at the University of California. 2002. Improved Estimates of Tree-Shade Effects on Residential Energy Use. Journal of Energy and Buildings. Volume 34, p. 1067-1076.

10.1.5 Implement Strategies to Reduce Urban Heat-Island Effect

Range of Effectiveness: The reduction in GHG emissions is not quantifiable at this time, therefore this mitigation measure should be implemented as a Best Management Practice. If the study data were updated to account for Title 24 standards, the GHG emissions reductions could be quantified but would vary based on location, building type, and building size.

Measure Description:

The urban heat island effect is the phenomenon in which a metropolitan area is warmer than its surrounding rural areas due to increased land surface which retains heat, such as concrete, asphalt, metal, and other materials found in buildings and pavements. This warming effect causes warmer locations, such as many cities in California, to require more energy for air conditioning and refrigeration than the surrounding rural areas. Higher energy requirements in turn result in higher CO_2 emissions from the generation of this energy.

Three strategies have been shown to have a positive impact on reducing localized temperatures and reducing the electricity demand for building cooling. These strategies are planting urban shade trees, installing reflective roofs, and using light-colored or high-albedo[113] pavements and surfaces. Planting shade trees around buildings and installing reflective roofs have both been found to result in direct electricity savings for buildings. The per building direct electricity savings from planting shade trees is discussed in a separate mitigation measure. Reflective roofs are covered under Title 24 Part 6 and the electricity savings is therefore incorporated in savings due to Title 24. The combination of the three strategies, however, has been shown to have a city-wide effect: a reduction in ambient air temperature. This reduction in air temperature results in buildings requiring less electricity for cooling, and is quantified as indirect savings in electricity use. The savings can be quantified on a per-building basis or on a city-wide basis.

A study entitled “Calculating energy-saving potentials of heat-island reduction strategies” conducted by the Lawrence Berkeley National Laboratory (LBNL) Heat Island Group provides a method to quantify per-building reductions in electricity use from implementing these three strategies on a city-wide scale. In addition, the study reports modeled city-wide electricity savings. The electricity reductions are based on a LBNL model with certain assumptions about the number and orientation of shade trees

[113] The albedo ratio of a surface represents how strongly the surface reflects sunlight. Pavements with higher albedo ratios reflect more sunlight and therefore retain less heat.

and the albedo values of roofs and pavements. Per-building electricity savings are also based on for two building stocks: Pre-1980 buildings (buildings constructed prior to 1980) and 1980+ buildings (buildings constructed on or after 1980).

This mitigation measure describes how to estimate greenhouse gas emissions reductions from implementing heat-island effect reduction strategies as reported in the LBNL study. Since the LBNL model is based on electricity data for Pre-1980 and 1980+ buildings[114] it does not incorporate electricity use improvements due to the California 2001, 2005, or 2008 Title 24 measures. Given that buildings constructed in 2001 or later incorporate Title 24 electricity efficiency improvements, the electricity savings reported in the LBNL study are overestimates of the savings that would actually be achieved for these newer buildings.[115]

While the electricity savings in the study overestimates savings for newer buildings, the data does show that electricity savings (and associated greenhouse gas emissions savings) from planting shade trees are real. A follow-up study which uses similar methodologies with models updated with the Title 24 standards would provide data which could be used to more accurately quantify electricity savings for new buildings.

Measure Applicability:

- Electricity use
- Limitation: It takes several years for trees to grow to the height necessary to provide shade to a building. Furthermore, without deed restrictions, the presence of shade trees around a building may not be permanent, as a new owner may decide to remove the trees or not replace them if they die.
- Limitation: it is assumed that the heat-island effect reduction strategies are implemented on a city-wide scale.

Inputs:

The following information needs to be provided by the Project Applicant:

- Type of building (residential, office, or retail store)
- Square footage of roof

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[114] This data for these buildings is based on U.S. Department of Energy and California Energy Commission studies conducted in 1987 through 2001.

[115] The CEC 2003 Impact Analysis Report estimates a state-average 14.9%-26% savings in electricity use for cooling in residential buildings and 6.7% savings in electricity use for cooling in non-residential buildings due to the 2005 update to the 2001 Title 24 standards. The CEC 2007 Impact Analysis Report estimates a state-average 19.7%-22.7% savings in overall electricity use for residential buildings and a 8.3% savings in electricity use for cooling in non-residential buildings due to the 2008 update to the 2005 Title 24 standards.

- Heating Degree Days (HDD) or Cooling Degree Days (CDD) of Project location

Baseline Method:

The CEC Residential Appliance Saturation Survey (RASS) and California Commercial Energy Use Survey (CEUS) datasets can be used to calculate the baseline electricity for building cooling. The data is available for different climate zones in California and electricity use from cooling alone can be extracted. The methodology for using RASS and CEUS to calculate $GHG_{baseline}$ is described in the baseline document.

Mitigation Method:

The electricity savings from reduced cooling demand are based on the location of the building. Table 4 of the LBNL study provides a list of cities and their HDD and CDD values. If a project's location is not listed, the Project Applicant should choose a representative city with climate similar to that of the project. Alternatively, the Project Applicant could determine the HDD and CDD of the project location from local meteorological data.

Tables 6 through 16 of the LBNL study show the expected electricity savings (in kWh per 1000 sqft of roof) based on the following parameters:

- Building type (residential, office, or retail store)
- Climate method (HDD or CDD – either can be used)
- Heating method (Gas heated-buildings or electric-heated buildings)

The Project Applicant should select data based on the appropriate parameters above. The entry corresponding to the "Indirect Savings" row and "1980+" column will provide the electricity savings in kWh per 1000 sqft of roof for the specified building type, climate method, and heating method. Note that value is an overestimate of savings for buildings which were manufactured under Title 24 standards.

Then the reduction in GHG emissions is calculated as follows:

$$GHG_{reduction} = SF \times ElecSavings \times Utility$$

Where

$GHG_{reduction}$	=	Reduction in GHG emissions from implementing heat island effect reduction strategies on a city-wide scale (MT)
SF	=	Sqft of roof Provided by Applicant
ElecSavings	=	Electricity savings (kWh / sqft roof) From Tables 6 through 16 of LBNL study
Utility	=	Carbon intensity of local utility (MT CO_2e / kWh)

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GP-5

From Table below

Power Utility	Carbon-Intensity (lbs CO_2e/MWh)
LADW&P	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

Therefore:

$$\text{Percent reduction in GHG emissions} = GHG_{reduction} / GHG_{baseline}$$

Since the Utility term is a factor of both $GHG_{reduction}$ and $GHG_{baseline}$, the percent reduction in GHG emissions does not depend on the value of Utility.

City-Wide GHG reductions
The LBNL study estimates that city-wide reductions in electricity use (and associated GHG emissions) range from about 10-20%. This range is based on the percent indirect savings modeled for five pilot cities: Houston, Baton Rouge, Chicago, Sacramento, and Salt Lake City, as reported in Figure 2 of the LBNL study.

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	The following per-building emissions reductions reflect the implementation of three heat island reduction strategies (installing reflective roofs, planting shade trees, and using high-albedo pavements) for the 1980+ stock buildings. Actual savings are expected to be lower for new buildings due to the Title 24 standards. • 20% for residential buildings • 5-12% for office buildings • 10-17% for retail buildings
All other pollutants	Same as above[116]

[116] Criteria air pollutant emissions may also be reduced due to the reduction in energy use; however, the reduction may not be in the same air basin as the project.

Assumptions:

Data based upon the following reference:

- H. Akbari, S. Konopacki. Lawrence Berkeley National Laboratory. 2005. Calculating Energy-Saving-Potentials of Heat-Island Reduction Strategies. Journal of Energy Policy. Volume 33, p. 721-756.
- S. Konopacki, H. Akbari. Lawrence Berkeley National Laboratory. 2000. Energy Savings Calculations for Heat Island Reduction Strategies in Baton Rouge, Sacramento, and Salt Lake City. LBNL 42890.

Preferred Literature:

The LBNL study conducted by Akbari and Konopacki of the Heat Island Group modeled energy savings from shade trees for residential, office, and retail building types. The model accounted for differences in climate by modeling in a range of heating-degree-days and cooling-degree days, and compared a basecase (building with no external shading) to a mitigated case (building with 4, 8, and 10 shade trees, depending on the building type). However, the study is based on pre-2001 data and does not account for updates to California's Title 24 standards. Furthermore, the model assumes a specific number of shade trees planted at specific orientations.

Alternative Literature:

None

Other Literature Reviewed:

Lawrence Berkeley National Laboratory. Heat Island Group: Benefits of Cooler Pavements. Available online at: http://eetd.lbl.gov/HeatIsland/Pavements/Overview/Pavements99-01.html. Accessed March 2010.

Lawrence Berkeley National Laboratory. Heat Island Group: The Cost of Hot Pavements. Available online at: http://heatisland.lbl.gov/Pavements/Cost.html. Accessed March 2010.

USEPA. Draft. Reducing Urban Heat Islands: Compendium of Strategies, Cool Pavements. Available online at: http://epa.gov/heatisland/resources/pdf/CoolPavesCompendium.pdf

Appendix A

List of Acronyms and Glossary of Terms

List of Acronyms

ACM	alternative calculation method
AF	acre feet
B20	biodiesel (20%)
BOD	biochemical oxygen demand
BMP	best management practice
C	carbon
CAFE	corporate average fuel economy
CAPCOA	California Air Pollution Control Officers Association
CAR	Climate Action Registry
CARB	California Air Resources Board
CCAR	California Climate Action Registry
CDWR	California Department of Water Resources
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CEUS	California Commercial End-Use Survey
CGBSC	California Green Building Standards Code
CH_4	methane
CHP	combined heat and power
CIWMB	California Integrated Waste Management Board
CNG	compressed natural gas
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DE	destruction efficiency
DEIR	Draft Environmental Impact Report
DU	dwelling unit
EF	emission factor
EIA	United States Energy Information Administration
EIR	Environmental Impact Report
EMFAC	on-road vehicle emission factors model
ET_0	reference evapotranspiration
ETWU	estimated total water use
FCZ	forecasting climate zone
GHG	greenhouse gas
GP	General Plan
GRP	General Reporting Protocol
GWP	global warming potential
HA	hydrozone area
HHV	higher heating value
hp	horsepower
HVAC	heating, ventilating, and air conditioning
IE	irrigation efficiency
IPCC	Intergovernmental Panel on Climate Change
ITE	Institute of Transportation Engineers
ITS	intelligent transportation systems
kBTU	thousand British thermal units
kW	kilowatt
kWh	kilowatt-hour
kWh/yr	kilowatt-hours/year
lbs	pounds

LA	landscape area
LADWP	Los Angeles Department of Water and Power
LCA	life cycle assessment
LDA	light-duty auto
LDT	light-duty truck
LED	light-emitting diode
LFM	landfill methane
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MAWA	maximum applied water allowance
MMBTU	million British thermal units
MSW	mixed solid waste
MTCE	metric tonnes carbon equivalent
N_2O	nitrous oxide
NOx	nitrogen oxides
NRDC	Natural Resources Defense Council
NREL	National Renewable Energy Laboratory
OLED	organic light-emitting diode
OFFROAD	off-road vehicle emission factors model
PF	plant factor
PG&E	Pacific Gas and Electric
PM	particulate matter
PUP	Power/Utility Protocol
RASS	Residential Appliance Saturation Survey
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SDGE	San Diego Gas and Electric
SLA	special landscape area
SMAQMD	Sacramento Metropolitan Air Quality Management District
SMUD	Sacramento Municipal Utility District
scf	standard cubic feet
SHP	separate heat and power
SO_2	sulfur dioxide
sqft	square feet
TDM	transportation demand management
TDV	time dependent valuation
TOD	transit-oriented development
tonnes	metric tonnes; 1,000 kilograms
TRU	truck refrigeration unit
URBEMIS	Urban Emissions Model
US	United States
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
VCAPCD	Ventura County Air Pollution Control District
VTPI	Victoria Transport Policy Institute
VMT	vehicle miles traveled
VTR	vehicle trip reduction
WARM	Waste Reduction Model
WMO	World Meteorological Organization
yr	year

Glossary of Terms

Alternative Calculation Method
Software used to demonstrate compliance with the California Building Energy Efficiency Standards (Title 24). The software must comply with the requirements listed in the Alternative Calculation Method Approval Manual.

Additionality[a]
The reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of the project. The project should not subsidize or take credit for emissions reductions which would have occurred regardless of the project.

Albedo[a]
The fraction of solar radiation reflected by a surface or object, often expressed as a ratio or fraction. Snow covered surfaces have a high albedo; the albedo of soils ranges from high to low; vegetation covered surfaces and oceans have a low albedo. The Earth"s albedo varies mainly through varying cloudiness, snow, ice, leaf area, and land cover changes. Paved surfaces with high albedos reflect solar radiation and can help reduce the urban heat island effect.

Below Market Rate Housing
Housing rented at rates lower than the market rate. Below market rate housing is designed to assist lower-income families. When below market rate housing is provided near job centers or transit, it provides lower income families with desirable job/housing match or greater opportunities for commuting to work through public transit.

Biochemical Oxygen Demand
Represents the amount of oxygen that would be required to completely consume the organic matter contained in wastewater through aerobic decomposition processes. Under the same conditions, wastewater with higher biochemical oxygen demand (BOD) concentrations will generally yield more methane than wastewater with lower BOD concentrations. BOD_5 is a measure of BOD after five days of decomposition.

Biogenic Emissions[b]
Carbon dioxide emissions produced from combusting a variety of biofuels, such as biodiesel, ethanol, wood, wood waste and landfill gas.

Carbon Dioxide Equivalent
A measure for comparing carbon dioxide with other greenhouse gases. Tonnes carbon dioxide equivalent is calculated by multiplying the tonnes of a greenhouse gas by its associated global warming potential.

California Environmental Quality Act
A statute passed in 1970 that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

Carbon Neutral Power
A power generation system which has net zero carbon emissions. Examples of existing carbon neutral power systems are photovoltaics, wind turbines, and hydropower systems.

Carbon Sink
Any process or mechanism that removes carbon dioxide from the atmosphere. A forest is an example of a carbon sink, because it sequesters carbon dioxide from the atmosphere.

"Carrot"
The purpose of a carrot is to provide an incentive which encourages a particular action. Parking cash-out would be considered a "carrot" since the employee receives a monetary incentive for not driving to work, but is not punished for maintaining status quo.

Combined Heat and Power
Also known as cogeneration. Combined heat and power is the generation of both heat and electricity from the same process, such as combustion of fuel, with the purpose of utilizing or selling both simultaneously. In combined heat and power systems, the thermal energy byproducts of a process are captured and used, where they would be wasted in a separate heat and power system. Examples of combined heat and power systems include gas turbines, reciprocating engines, and fuel cells.

Compact Infill
A Project which is located within or contiguous with the central city. Examples may include redevelopment areas, abandoned sites, or underutilized older buildings/sites.

Climate Zone
Geographic area of similar climatic characteristics, including temperature, weather, and other factors which affect building energy use. The California Energy Commission identified 16 Forecasting Climate Zones (FCZs) for use in the CEUS and RASS analyses. The designation of these FCZs was based in part on the utility service area.

Cordon Pricing
Tolls charged for entering a particular area (a "cordon"), such as a downtown.

Density
The amount of persons, jobs, or dwellings per unit of land area. This is an important metric for determining traffic-related parameters.

Destination Accessibility
A measure of the number of jobs or other attractions reachable within a given travel time. Destination accessibility tends to be highest at central locations and lowest at peripheral ones.

Efficacy
The capacity to produce a desired effect.

ENERGY STAR
A joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy which sets national standards for energy efficient consumer products. ENERGY STAR certified products are guaranteed to meet the efficiency standards specified by the program.

Elasticity
The percentage change of one variable in response to a percentage change in another variable. Elasticity = percent change in variable A / percent change in variable B (where the

change in B leads to the change in A). For example, if the elasticity of VMT with respect to density is -0.12, this means a 100% increase in density leads to a 12% decrease in VMT.

Evapotranspiration[c]
The loss of water from the soil both by evaporation and by transpiration from the plants growing in the soil.

General Plan
A set of long-term goals and policies that guide local land use decisions. The 2003 *General Plan Guidelines* developed by the California Office of Planning and Research provides advice on how to write a general plan that expresses a community's long-term vision, fulfills statutory requirements, and contributes to creating a great community.

Global Warming Potential[b]
The ratio of radiative forcing that would result from the emission of one kilogram of a greenhouse gas to that from the emission of one kilogram of carbon dioxide over a fixed period of time.

Graywater
Non-drinkable water that can be collected and reused onsite for irrigation, flushing toilets, and other purposes. This water has not been processed through a waste water treatment plant.

Greenhouse Gas
For the purposes of this report, greenhouse gases are the six gases identified in the Kyoto Protocol: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Headway
The amount of time (in minutes) that elapses between two public transit vehicles servicing a given route and given line. Headways for buses and rail are generally shorter during peak periods and longer during off-peak periods. Headway is the inverse of frequency (headway = 1/frequency), where frequency is the number of arrivals over a given time period (i.e. buses per hour).

Intelligent Transportation System
A broad range of communications-based information and electronics technologies integrated into transportation system infrastructure and vehicles to relieve congestion and improve travel safety.

Job Center
An area with a high degree and density of employment.

Kilowatt Hour
A unit of energy. In the U.S., the kilowatt hour is the unit of measure used by utilities to bill consumers for energy use.

Land Use Index
Measures the degree of land use mix of a development. An index of 0 indicates a single land use while 1 indicates a full mix of uses.

Lumen
A unit of luminous flux. A measure of the brilliance of a source of visible light, or the power of light perceived by the human eye.

Master Planned Community
Large communities developed specifically incorporating housing, office parks, recreational area, and commercial centers within the community. Master planned communities tend to encompass a large land area with the intent of being self-sustaining. Many master planned communities may have lakes, golf courses, and large parks.

Mixed Use
A development that incorporates more than one type of land use. For example, a small mixed use development may have buildings with ground-floor retail and housing on the floors above. A larger mixed use development will locate a variety of land uses within a short proximity of each other. This may include integrating office space, shopping, parks, and schools with residential development. The mixed-use development should encourage walking and other non-auto modes of transport from residential to office/commercial/institutional locations (and vice versa).

Ordinance
A local law usually found in municipal code.

Parking Spillover
A term used to describe the effects of implementing a parking management strategy in a sub-area that has unintended consequences of impacting the surrounding areas. For example, assume parking meters are installed on all streets in a commercial/retail block with no other parking strategies implemented. Customers will no longer park in the metered spots and will instead "spillover" to the surrounding residential neighborhoods where parking is still unrestricted.

Photovoltaic[c]
A system that converts sunlight directly into electricity using cells made of silicon or other conductive materials (solar cells). When sunlight hits the cells, a chemical reaction occurs, resulting in the release of electricity.

Recycled Water
Non-drinkable water that can be reused for irrigation, flushing toilets, and other purposes. It has been processed through a wastewater treatment plant and often needs to be redistributed.

Ride Sharing
Any form of carpooling or vanpooling where additional passengers are carried on the trip. Ride-sharing can be casual and formed independently or be part of an employer program where assistance is provided to employees to match up commuters who live in close proximity of one another.

Renewable Energy[a]
Energy sources that are, within a short time frame relative to the Earth‟s natural cycles, sustainable, and include non-carbon technologies such as solar energy, hydropower, and wind, as well as carbon-neutral technologies such as biomass.

Self Selection
When an individual selects himself into a group.

Separate Heat and Power
The typical system for acquiring heat and power. Thermal energy and electricity are generated and used separately. For example, heat is generated from a boiler while electricity is acquired from the local utility. Separate heat and power systems are used as the baseline of comparison for combined heat and power systems.

Sequestration[a]
The process of increasing the carbon content of a carbon reservoir other than the atmosphere. Biological approaches to sequestration include direct removal of carbon dioxide from the atmosphere through afforestation, reforestation, and practices that enhance soil carbon in agriculture. Physical approaches include separation and disposal of carbon dioxide from flue gases or from processing fossil fuels to produce hydrogen- and carbon dioxide-rich fractions and longterm storage in underground in depleted oil and gas reservoirs, coal seams, and saline aquifers.

"Stick"
The purpose of a stick is to establish a penalty for a status quo action. Workplace parking pricing would be considered a "stick" since the employee is now monetarily penalized for driving to work.

Suburban
An area characterized by dispersed, low-density, single-use, automobile dependent land use patterns, usually outside of the central city (a suburb).

Suburban Center
The suburban center serves the population of the suburb with office, retail and housing which is denser than the surrounding suburb.

Title 24
Title 24 Part 6 is also known as the California Building Energy Efficiency Standard, which regulates building energy efficiency standards. Regulated energy uses include space heating and cooling, ventilation, domestic hot water heating, and some hard-wired lighting. Title 24 determines compliance by comparing the modeled energy use of a „proposed home‟ to that of a minimally Title 24 compliant „standard home‟ of equal dimensions. Title 24 focuses on building energy efficiency per square foot; it places no limits upon the size of the house or the actual energy used per dwelling unit. The current Title 24 standards were published in 2008.

Transit-Oriented Development
A development located near and specifically designed around a rail or bus station. Proximity alone does not characterize a development as transit-oriented. The development and surrounding neighborhood should be designed for walking and bicycling and parking management strategies should be implemented. The development should be located within a short walking distance to a high-quality, high frequency, and reliable bus or rail service.

Transportation Demand Management
Any transportation strategy which has an intent to increase the transportation system efficiency and reduce demand on the system by discouraging single-occupancy vehicle travel and encouraging more efficient travel patterns, alternative modes of transportation such as walking, bicycling, public transit, and ridesharing. TDM measures should also shift travel patterns from peak to off-peak hours and shift travel from further to closer destinations.

Transit Ridership
The number of passengers who ride in a public transportation system, such as buses and subways.

Tree and Grid Network
Describes the layout of streets within and surrounding a project. Streets that are characterized as a tree network actually look like a tree and its branches. Streets are not laid out in any uniform pattern, intersection density is low, and the streets are less connected. In a grid network, streets are laid out in a perpendicular and parallel grid pattern. Streets tend to intersect more frequently, intersection density is higher, and the streets are more connected.

Urban
An area which is located within the central city with higher density of land uses than you would find in the suburbs. It may be characterized by multi-family housing and located near office and retail.

Urban Heat Island Effect
The phenomenon in which a metropolitan area is warmer than its surrounding rural areas due to increased land surface which retains heat, such as concrete, asphalt, metal, and other materials found in buildings and pavements.

Vehicle Miles Traveled
The number of miles driven by vehicles. This is an important traffic parameter and the basis for most traffic-related greenhouse gas emissions calculations.

Vehicle Occupancy
The number of persons in a vehicle during a trip, including the driver and passengers.

Notes:

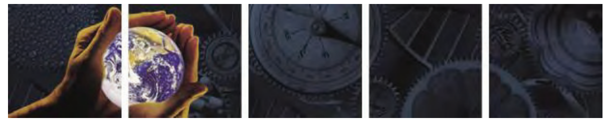
[a] Definition adapted from: IPCC. 2001. Third Assessment Report: Climate Change 2001 (TAR). Annex B: Glossary of Terms. Available online at: http://www.ipcc.ch/pdf/glossary/tar-ipcc-terms-en.pdf

[b] Definition adapted from: CCAR. 2009. General Reporting Protocol, Version 3.1. Available online at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

[c] Definition adapted from: USEPA. 2010. Greening EPA Glossary. Available online at: http://www.epa.gov/oaintrnt/glossary.htm

Appendix B

Greenhouse Gas Mitigation Measures Task 0:
Standard Approach to Calculate Unmitigated Emissions



Greenhouse Gas Mitigation Measures Task 0: Standard Approach to Calculate Unmitigated Emissions

Prepared for:
California Pollution Control Officers Association (CAPCOA)

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Date:
August 2010

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TRANSPORTATION CONSULTANTS

ENVIRON

Contents

1 Introduction

ENVIRON International Corporation (ENVIRON) and Fehr & Peers worked with the California Air Pollution Control Officers Association (CAPCOA) to quantify reductions associated with greenhouse gas (GHG) mitigation measures that can be applied to California Environmental Quality Act (CEQA) Environmental Impact Report (EIR) analyses. The first part of this overall task defines a standard approach to calculate the baseline emissions before mitigation. This report contains the recommendations for methodologies and approaches to assess the baseline GHG emissions.

This report and its methodologies form the basis for the subsequent tasks associated with quantification of GHG mitigation measures. To the extent possible, default values are included with this report and in the mitigation measure Fact Sheets.

This report presents methods to be used to calculate short-term and one-time emissions sources as well as emissions that will occur annually after construction (operational emissions). The one-time emission sources include changes in carbon sequestration due to vegetation changes and emissions associated with construction. The annual operational emissions include the emissions associated with building energy use including natural gas and electricity, emissions associated with mobile sources, emissions associated with water use and wastewater treatment, emissions associated with area sources such as natural gas fired hearths , landscape maintenance equipment, swimming pools, and golf courses.

2 GHG Equivalent Emissions

The term "GHGs" includes gases that contribute to the greenhouse effect, such as carbon dioxide (CO_2,) methane (CH_4), and nitrous oxide (N_2O), as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons (CFCs), and sulfurhexafluoride (SF_6). These last three families of gases, while not naturally present in the atmosphere, have properties that also cause them to trap infrared radiation when they are present in the atmosphere, thus making them GHGs. These six gases comprise the major GHGs that are recognized by the Kyoto Accords (water is not included).[1] There are other GHGs that are not recognized by the Kyoto Accords, due either to the smaller role that they play in climate change or the uncertainties surrounding their effects. Atmospheric water vapor is not recognized by the Kyoto Accords because there is not an obvious correlation between water concentrations and specific human activities. Water appears to act in a positive feedback manner; higher temperatures lead to higher water vapor concentrations in the atmosphere, which in turn can cause more global warming.[2] California has recently recognized nitrogen trifluoride as another regulated greenhouse gas.

[1] This Kyoto Protocol sets legally binding targets and timetables for cutting the greenhouse gas emissions of industrialized countries. The US has not approved the Kyoto treaty.

[2] From the IPCC Third Assessment Report: http://www.grida.no/climate/ipcc_tar/wg1/143.htm and http://www.grida.no/climate/ipcc_tar/wg1/268.htm

Residents and the employees and patrons of commercial and municipal buildings and services use electricity, heating, water, and are transported by motor vehicles. These activities directly or indirectly emit GHGs. The most significant GHG emissions resulting from such residential and commercial developments are emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). GHG emissions are typically measured in terms of MT of CO_2 equivalents (CO_2e), calculated as the product of the mass emitted of a given GHG and its specific global warming potential (GWP).

The effect that each of these gases can have on global warming is a combination of the mass of their emissions and their global warming potential (GWP). GWP indicates, on a MT for MT basis, how much a gas is predicted to contribute to global warming relative to how much warming would be predicted to be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent GHGs than CO_2, with GWPs of 21 and 310, respectively according to the IPCC's Second Assessment Report (SAR).[3] In emissions inventories, GHG emissions are typically reported in terms of pounds (lbs) or MT[4] of CO_2 equivalents (CO_2e). CO_2e are calculated as the product of the mass emitted of a given GHG and its specific GWP. While CH_4 and N_2O have much higher GWPs than CO_2, CO_2 is emitted in such vastly higher quantities that it accounts for the majority of GHG emissions in CO_2e, both from developments and human activity in general. Since most regulatory agencies and protocols use the SAR GWP values as a basis, this assessment will also use SAR GWP values even though more recent values exist. However, SAR did not consider nitrogen trifluoride, however there are no sources of nitrogen trifluoride that would typically need to be quantified.

3 Units of measurement: MT of CO_2 and CO_2e

In many sections of this report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

Emissions and reductions are calculated in terms of metric tons. As such, "MT" will be used to refer to metric tons (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 pounds [lbs]).

4 Indirect GHG Emissions from Electricity Use

As noted above, indirect GHG emissions are created as a result of electricity use. When electricity is used in a building, the electricity generation typically takes place offsite at the power plant; electricity use in a building generally causes emissions in an indirect manner. The project should use information specific for each local utility provider for different parts of

[3] GWP values from IPCC's Second Assessment Report (SAR, 1996) are still used by international convention and are used in this protocol, even though more recent (and slightly different) GWP values were developed in the IPCC's Fourth Assessment Report (FAR, 2007)

[4] In this report, "MT" will be used to refer to metric MT (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 pounds).

California. Accordingly, indirect GHG emissions from electricity usage are calculated using the utility specific carbon-intensity factor based Power/Utility Protocol (PUP) report from California Climate Action Registry (CCAR)[5] for the 2006 baseline year. ENVIRON does not recommend using the 2004 PUP reports since this year was one of the first year's utilities reported emissions, as such, the data is likely less accurate than subsequent years since utilities had a chance to refine data collection methods for the later years. Furthermore, a large coal burning power plant in Mojave was going offline in 2005 which was factored into the Scoping Plan analysis. Therefore, ENVIRON suggests using the 2006 PUP reports since it likely represents a more accurate dataset year. This emission factor takes into account the baseline year's mix of energy sources used to generate electricity for a specific utility and the relative carbon intensities of these sources. The emission factor will be determined as a CO_2e incorporating the CO_2, CH_4, and N_2O emissions.

Power Utility	Carbon-Intensity (lbs CO_2e/MWh)
LADW&P	1,238
PG&E	456
SCE	641
SDGE	781
SMUD	555

5 Short-Term Emissions

Short-term or one-time emissions from the development of a Project are associated with vegetation removal and re-vegetation on the Project site and construction-related activities.

5.1 Construction Activities

Construction activities occur during the early stage of a project. Construction activities include any demolition, site grading, building construction, and paving. These construction activities have several main sources of GHG emissions. Off-road construction equipment such as dozers, pavers, and backhoes are used on-site during construction. These pieces of equipment typically are diesel fueled although other fuels are occasionally used. Besides the off-road construction, there are on-road vehicles. These vehicles are used for worker commuting, delivering of material to the site, and hauling material away from the site. The methodology to calculate these sources of emissions is described in the next sections.

5.1.1 Estimating GHG Emissions from Off-Road Construction Equipment

This section describes how emissions from off-road equipment used during demolition, site grading, building construction and paving are calculated. This section can be used for any fuel

[5] California Climate Action Registry (CCAR) Database. PUP Report.

burning equipment such as diesel, gasoline, or compressed natural gas (CNG). For electric equipment please see the method in the next section.

First, the number and type of equipment that will be used in the construction, as well as the duration of the entire construction project, is needed. Absent other data, ENVIRON recommends that each piece of equipment will operate for 8 hours a day, five days a week throughout the construction duration. An equipment hour is defined as one hour of a piece of equipment being used. Specifications for each type of construction equipment (horsepower, load factor, and GHG emission factor) are provided by OFFROAD2007[6]. CO_2 and CH_4 emissions for each type of construction equipment are calculated as follows:

$$\begin{array}{c} \textit{Equipment} \\ \textit{Emissions [grams]} \end{array} = \begin{array}{c} \textit{Total} \\ \textit{equipment} \\ \textit{hours} \end{array} \times \begin{array}{c} \textit{emission factor} \\ \textit{[grams per brake} \\ \textit{horsepower-hour]} \end{array} \times \begin{array}{c} \textit{equipment} \\ \textit{horsepower} \end{array} \times \textit{load factor}^{7}$$

The grams of CO_2 and CH_4 are multiplied by their respective GWP and then the two emissions are summed to derive the final CO_2e emissions from the piece of off-road equipment. Since OFFROAD2007 does not provide an emission factor for N_2O which is a minor subset of nitrogen oxides (NO_x) emissions and the contribution to the overall GHG emissions is likely small, it is therefore not included in calculations that used OFFROAD2007. These were accounted for with alternative fuels since they have a larger proportion of N_2O and CH_4.

5.1.2 Estimating GHG emissions from Electric Off-Road Construction Equipment

In order to estimate the indirect GHG emissions associated with electricity consumption of electrical powered equipment, the following inputs are required. First, the total operating hours of the electrical piece of equipment is needed. Secondly, the amount of kilowatts the equipment uses per time is needed. These two pieces are used along with the carbon intensity factor for the local utility provider as follows:

$$\begin{array}{c} \textit{Equipment} \\ \textit{Emissions} \end{array} = \begin{array}{c} \textit{Total} \\ \textit{equipment hours} \end{array} \times \begin{array}{c} \textit{average power} \\ \textit{draw (kW/hr)} \end{array} \times \begin{array}{c} \textit{Utility EF} \\ \textit{(g } CO_2\textit{e per kWhr)} \end{array}$$

5.1.3 GHG Emissions from On-Road Vehicles Associated with Construction

Emissions from on-road vehicles associated with construction include workers commuting to the site, vendors delivering materials, and hauling away of materials. GHGs are emitted from these vehicles in two ways: running emissions, produced by driving the vehicle, and startup emissions, produced by turning the vehicle on. Idling emissions will not be considered since

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[6] OFFROAD2007 is a model developed by the Air Resources Board which contains emission factors for off-road equipment. It is available at : http://www.arb.ca.gov/msei/offroad/offroad.htm

[7] Load factor is the percentage of the maximum horsepower rating at which the equipment normally operates.

regulations exist which limit idling[8] and they would represent a small contribution to the GHG emissions. The majority of these on-road vehicle emissions are running emissions.

Running emissions are calculated using the same method for all trip types. The total Vehicle Miles Traveled (VMT) for the trip type category is estimated, and then multiplied by the representative GHG emission factors for the vehicles expected to be driven. The total VMT for a given trip type is calculated as follows:

$$VMT \quad = \quad \textit{Number of round trips} \quad x \quad \textit{average round trip length (miles)}$$

The number of trips should be based on project specific information. Default values associated with each land use type can be obtained construction cost estimators or default values in emission estimator programs. Average round trip length should be based on project specific information or county specific default values. After total VMT is calculated, GHG emissions for on-road vehicles associated with construction can be calculated from the following equation:

$$CO_2 \textit{ emissions} \quad = \quad VMT \quad x \quad EF_{running}$$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = running emission factor for vehicle fleet for trip type

The CO_2 calculation involves the following assumptions:

a. Vehicle Fleet Defaults:

   a. Workers commute half with light duty trucks (LDTs) and half commute in light duty autos (LDAs). Half of the LDTs are type 1 and the other half type 2.

   b. Vendors are all heavy-heavy duty vehicles.

   c. Hauling is all heavy-heavy duty vehicles.

b. The emission factor depends upon the speed of the vehicle. A default value of 35 miles per hour will be used.

c. EMFAC emission factors from the construction year will be used for $EF_{running}$.

[8] The Air Resources Board adopted in 2004 and modified in 2005 an Air Toxic Control Measure that limits idling in diesel vehicles to 5-minutes. http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm

The emissions associated with CH_4 and N_2O are calculated in a similar manner or assumed to represent 5% of the total CO_2e emissions. They are then converted to CO_2e by multiplying by their respective global warming potential.

Startup emissions are CO_2 emitted from starting a vehicle. For the various trips during all phases, the startup emissions are calculated using the following assumptions:

a. The same vehicle fleet assumptions as used in running emissions.

b. Two engine startups per day with a 12 hour wait before each startup.[9]

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[10] To incorporate these additional GHGs into the calculations, the total GHG footprint is calculated by dividing the CO_2 emissions by 0.95.

5.2 Vegetation Change

ENVIRON suggests following the IPCC protocol for vegetation since it has default values that work well with the information typically available for development projects. This method is similar to the CCAR Forest Protocol[11] and the Center for Urban Forest Research Tree Carbon Calculator[12], but it has more general default values available that will generally applicable to all areas of California without requiring detailed site-specific information[13].

5.2.1 Quantifying the One-Time Release by Changes in Carbon Sequestration Capacity

The one-time release of GHGs due to permanent changes in carbon sequestration capacity is calculated using the following four steps:[14]

1. *Identify and quantify the change in area of various land types due to the development (i.e. alluvial scrub, non-native grassland, agricultural, etc.).* These area changes include not only the area of land that will be converted to buildings, but also areas disrupted by the construction of utility corridors, water tank sites, and associated borrow and grading areas.

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[9] The emission factor grows with the length of time the engine is off before each ignition.

[10] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February.

[11] CCAR. 2007. Forest Sector Protocol Version 2.1. September. Available at: http://www.climateregistry.org/resources/docs/protocols/industry/forest/forest_sector_protocol_version_2.1_sept2007.pdf

[12] Available at: http://www.fs.fed.us/ccrc/topics/urban-forests/ctcc/

[13] The CCAR Forest Protocol and Urban Forest Research Tree Carbon Calculator are not used since their main focus is annual emissions for carbon offset considerations. As such they are designed to work with very specific details of the vegetation that is not available at a CEQA level of analysis.

[14] This section follows the IPCC guidelines, but has been adapted for ease of use for these types of Projects.

Areas temporarily disturbed that will eventually recover to become vegetated will not be counted as vegetation removed as there is no net change in vegetation or land use.[15]

2. *Estimate the biomass associated with each land type.* For the purposes of this report, ENVIRON suggests using the available general vegetation types found in the IPCC publication Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines).[16]

   California vegetation is heavily dominated by scrub and chaparral vegetation which may not be accurately characterized by default forest land properties. Consequently, ecological zones and biomass based subdivisions identified in the IPCC Guidelines were used to sub-categorize the vegetation as scrub dominated. These subcategories should be used to determine the CO_2 emissions resulting from land use impacts.

3. *Calculate CO_2 emissions from the net change of vegetation.* When vegetation is removed, it may undergo biodegradation,[17] or it may be combusted. Either pathway results in the carbon (C) present in the plants being combined with oxygen (O_2) to form CO_2. To estimate the mass of carbon present in the biomass, biomass weight is multiplied by the mass carbon fraction, 0.5. [18] The mass of carbon is multiplied by 3.67[19] to calculate the final mass of CO_2, assuming all of this carbon is converted into CO_2.

4. Calculate the overall change in sequestered CO_2. – For all types of land that change from one type of land to another,[20] initial and final values of sequestered CO_2 are calculated using the equation below.

   Overall Change in Sequestered CO_2 [MT CO_2]

$$= \sum_i \left(SeqCO_2\right)_i \times \left(area\right)_i - \sum_j \left(SeqCO_2\right)_j \times \left(area\right)_j$$

   Where:

$SeqCO_2$	=	mass of sequestered CO_2 per unit area [MT CO_2/acre]
area	=	area of land for specific land use type [acre]
i	=	index for final land use type
j	=	index for initial land use type

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15 This assumption facilitates the calculation as a yearly growth rate and CO_2 removal rate does not have to be calculated. As long as the disturbed land will indeed return to its original state, this assumption is valid for time periods over 20 years.

16 Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

17 Cleared vegetation may also be deposited in a landfill or compost area, where some anaerobic degradation which will generate CH_4 may take place. However, for the purposes of this section, we are assuming that only aerobic biodegradation will take place which will result in CO_2 emissions only.

18 The fraction of the biomass weight that is carbon. Here, a carbon fraction of 0.5 is used for all vegetation types from CCAR Forest Sector Protocol.

19 The ratio of the molecular mass of CO_2 to the molecular mass of carbon is 44/12 or 3.67.

20 For example from forestland to grassland, or from cropland to permanently developed.

5.2.2 Calculating CO_2 Sequestration by Trees

Planting individual trees will sequester CO_2. Changing vegetation as described above results in a one-time carbon-stock change. Planting trees is also considered to result in a one-time carbon-stock change. Default annual CO_2 sequestration rates on a per tree basis, based on values provided by the IPCC are used[21]. An average of 0.035 MT CO_2 per year per tree can be used for trees planted, if the tree type is not known.

Urban trees are only net carbon sinks when they are actively growing. The IPCC assumes an active growing period of 20 years. Thereafter, the accumulation of carbon in biomass slows with age, and will be completely offset by losses from clipping, pruning, and occasional death. Actual active growing periods are subject to, among other things, species, climate regime, and planting density. In this report, the IPCC default value of 20 years is recommended. For large tree sequestration projects, the Project may consider using the Forest or Urban tree planting protocols developed by Climate Action Registry (CAR). These protocols have slightly different assumptions regarding steady state, tree growth, and replacement of trees..

5.3 Built Environment

The amount of energy used, and the associated GHG emissions emitted per square foot of available space vary with the type of building. For example, food stores are far more energy intensive than warehouses, which have little climate-conditioned space. Therefore, this analysis is specific to the type of building.

GHGs are emitted as a result of activities in buildings for which electricity and natural gas are used as energy sources. Combustion of any type of fuel emits CO_2 and other GHGs directly into the atmosphere; when this occurs within a building (such as by natural gas consumption) this is a direct emission source[22] associated with that building. GHGs are also emitted during the generation of electricity from fossil fuels. When electricity is used in a building, the electricity generation typically takes place offsite at the power plant; electricity use in a building generally causes emissions in an indirect manner.

Energy use in buildings is divided into energy consumed by the built environment and energy consumed by uses that are independent of the construction of the building such as plug-in appliances. In California, Title 24 part 6 governs energy consumed by the built environment, mechanical systems, and some fixed lighting. This includes the space heating, space cooling, water heating, and ventilation systems. Non-building energy use, or “plug-in” energy use can be further subdivided by specific end-use (refrigeration, cooking, office equipment, etc.). The following two steps are performed to quantify the energy use due to buildings:

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[21] The Center for Urban Forest Research Tree Carbon Calculator is not suggested since it requires knowledge on specific tree species to estimate carbon sequestered. This information is typically not available during the preparation of CEQA documents.

[22] California Climate Action Registry (CCAR) General Reporting Protocol (GRP), Version 3.1 (January). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf, Chapter 8

1. Calculate energy use from systems covered by Title 24[23] (HVAC system, water heating system, and the lighting system).
2. Calculate energy use from office equipment, plug-in lighting, and other sources not covered by Title 24.

The resulting energy use quantities are then converted to GHG emissions by multiplying by the appropriate emission factors obtained by incorporating information on local electricity providers for electricity, and by natural gas emission factors for natural gas combustion.

ENVIRON recommends using default values for Title 24 and non-Title 24 energy use for various building types. These will take into account the building size and climate zone. There are several sources of information that can be used to obtain building energy intensity. Each is described briefly below.

The *California Commercial Energy Use Survey* (CEUS) data is provided by the California Energy Commission (CEC). It is based on a survey conducted in 2002 for existing commercial buildings in various climate zones. Electricity and natural gas use per square foot for each end use in each building type and climate zone is extracted from the CEUS data. Since the data is provided by end use, it is straightforward to calculate the Title 24 and non-Title 24 regulated energy intensity for each building type.

Commercial Buildings Energy Consumption Survey (CBECS) is a survey of non-residential buildings that was conducted in 2003 by the Energy Information Administration (EIA). Electricity and natural gas use per square foot can be extracted from this data. The energy use estimates are assumed to represent 2001 Title 24 compliant buildings. Using CBECS, the percent of electricity and natural gas used for each end use can be calculated. It is then straightforward to calculate the Title 24 and non-Title 24 electricity and natural gas intensity for each building type. Similar surveys exist for manufacturing and residential energy use.

The *Residential Appliance Saturation Survey* (RASS) refers to the California Energy Commission Consultant Report entitled "California Statewide Residential Appliance Saturday Study". Data from RASS is used to calculate the total electricity and natural gas use for residential buildings on a per dwelling unit. The RASS study estimates the unit energy consumption (UEC) values for individual households surveyed and also provides the saturation number for each type of end use. The saturation number indicates the proportion of households that have a demand for each type of end-use category. As the data is provided by end use, it is straightforward to calculate the Title 24 and non-Title 24 electricity and natural gas intensity for each building type.

Alternative Calculation Method (ACM) software is available that makes estimates of the energy consumption by a model Title 24 compliant building. These programs provide

[23] Title 24, Part 6, of the California Code of Regulations: California's Energy Efficiency Standards for Residential and Nonresidential Buildings. http://www.energy.ca.gov/title24/

annual energy use for the heating, ventilation, and air conditioning (HVAC) system in each building; therefore, estimates from ACM software represent Title 24-regulated energy use. These do not calculate the non-Title 24 energy use for the buildings.

The Department of Energy produced the *Building America Research Benchmark Definition* (BARBD) technical manual, which presents empirical equations for electricity and natural gas usage. As the data is provided by end use, it is straightforward to calculate the Title 24 and non-Title 24 electricity and natural gas intensity for each building type.

Literature surveys may also be used for building and land use types not well represented by the above sources.

ENVIRON suggests using the CEUS and RASS datasets for these calculations since the data is available for several land use categories in different climate zones in California.

The Title 24 standards have been updated twice (in 2005 and 2008) since some of these data were compiled. CEC has published reports estimating the percentage deductions in energy use resulting from these new standards. Based on CEC's discussion on average savings for Title 24 improvements, these CEC savings percentages by end use can be used to account for reductions in electricity use due to updates to Title 24. Since energy use for each different system type (ie, heating, cooling, water heating, and ventilation) as well as appliances is defined, this method will easily allow for application of mitigation measures aimed at reducing the energy use of these devices in a prescriptive manner.

Based on the electricity intensity, CO_2e intensity values (CO_2e emissions per square foot or dwelling unit, as applicable, per year) for each building type can be calculated. Electricity intensity data is multiplied by an electricity emission factor to generate CO_2e intensity values. The total CO_2e emissions from each building type are calculated by multiplying the CO_2e intensity values by the appropriate metric (building square footage for non-residential buildings or number of dwelling units for residential buildings). Summing the CO_2e emissions from all building types gives the total CO_2e emissions from electricity use in Title 24 and non-Title 24 sources in buildings.

Based on the natural gas intensity, CO_2e intensity values (CO_2e emissions per square foot or dwelling unit, as applicable, per year) for each building type can be calculated. Natural gas intensity data is multiplied by a natural gas emission factor to generate CO_2e intensity values. The total CO_2e emissions from each building type are calculated by multiplying the CO_2 intensity values by the appropriate metric (building square footage for non-residential buildings or number of dwelling units for residential buildings). Summing the CO_2e emissions from all building types gives the total CO_2e emissions from natural gas use in Title 24 and non-Title 24 sources in buildings.

5.3.1 Natural Gas Boilers

GHG emissions from the combustion of natural gas are calculated as the product of natural gas consumption, natural gas heat content, and carbon-intensity factor. The Project Applicant has to determine the natural gas consumption, while the heat content and carbon-intensity factor can obtained from the CCAR General Reporting Protocol.

5.4 Area Sources

Area sources are local combustion of fuel. The area sources covered in this section include natural gas fireplaces/stoves and landscape maintenance equipment. Natural gas usage from the primary building heating is not included in this category since it is already included with building energy use. Each of these area sources is discussed further.

5.4.1 Natural Gas Fireplaces/Stoves

GHG emissions associated with natural gas fired fireplaces are calculated using emission factors from CCAR. The average BTU per hour for fireplaces in homes needs to be specified. Default values for annual fireplace usage varies for each County. Natural gas is assumed to have 1,020 BTU per standard cubic foot[24].

5.4.2 Landscape Maintenance

Landscape maintenance includes fuel combustion emissions from equipment such as lawn mowers, roto tillers, shredders/grinders, blowers, trimmers, chain saws, and hedge trimmers, as well as air compressors, generators, and pumps.

Similar to construction off-road equipment, emission factors are based on the OFFROAD2007 model. These are combined with the hours of operation for each equipment piece as well as the horsepower and load factors. The GHG emissions will be calculated based on the emission factors for the equipment and fuel reported from OFFROAD2007 and the appropriate GWP. Default usages (hours of operation) should be determined for the landscape equipment based on the Project needs.

5.5 Water

Delivering and treating water for use at the project site requires energy. This embodied energy associated with the distribution of water to the end user is associated with the electricity to pump and treat the water. GHG emissions due to water use are related to the energy used to convey, treat and distribute water. Thus, these emissions are indirect emissions from the production of electricity to power these systems.

The amount of electricity required to treat and supply water depends on the volume of water involved. Three processes are necessary to supply water to users: (1) supply and conveyance of the water from the source; (2) treatment of the water to potable standards; and (3) distribution of the water to individual users.

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[24] USEPA. 1998. AP-42 Emission Factors. Chapter 1.4 Natural Gas Combustion.

Therefore, to quantify the GHG emissions associated with the distribution of water to an end user, the carbon intensity of electricity is used along with the amount of electricity used in pumping and treating the water. Since consumption of water varies greatly for each land use type, default values need to be determined with several listed in the mitigation measure fact sheets. Since buildings may have different percentages of water associated with indoor and outdoor water usage, the water usage is quantified separately. In addition since mitigation measures associated with water use may be directed separately toward indoor and outdoor water usage, this will be beneficial for this task.

5.5.1 Indoor

Indirect emissions resulting from electricity use are determined by multiplying electricity use by the CO_2e emission factor provided by the local electricity supplier. Energy use per unit of water for different aspects of water treatment (e.g. source water pumping and conveyance, water treatment, distribution to users) is determined using the stated volumes of water and energy intensities values (i.e., energy use per unit volume of water) provided by reports from the California Energy Commission (CEC) on energy use for California's water systems.[25] The CEC report estimates the electricity required to extract and convey one million gallons of water. Using this energy intensity factor, the expected indoor water demand, and the utility-specific carbon-intensity factor, GHG emissions from indoor water supply and conveyance may be calculated.

The amount of electricity required to treat and distribute one million gallon of potable water is estimated in the CEC report. Based on the estimated indoor water demand, these energy intensity factors, and the utility-specific carbon intensity factor, GHG emissions from indoor water treatment and distribution may be calculated.

The sum of emissions due to supplying, conveying, treating, and distributing indoor water gives the total emissions due to indoor water use.

5.5.2 Outdoor

Indirect emissions resulting from electricity use are determined by multiplying electricity use by the CO_2 emission factor provided by the local electricity supplier. Energy use per unit of water for different aspects of water treatment (e.g. source water pumping and conveyance, water treatment, distribution to users) is determined using the stated volumes of water and energy intensities values (i.e., energy use per unit volume of water) provided by reports from the California Energy Commission (CEC) on energy use for California's water systems.[26] The

[25] CEC 2005. California's Water-Energy Relationship. Final Staff Report. CEC-700-2005-011-SF,

CEC 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.

[26] CEC 2005. California's Water-Energy Relationship. Final Staff Report. CEC-700-2005-011-SF,

CEC 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.

energy needed to supply and convey the water will be used to pump this water from the sources and distribute it throughout the development. The CEC report estimates the electricity required to extract and convey one million gallons of water. Using this energy intensity factor, the expected outdoor water demand, and the utility-specific carbon-intensity factor, GHG emissions from outdoor water supply and conveyance may be calculated.

The amount of electricity required to treat and distribute one million gallon of potable water (see recycled water for non-potable water) is estimated in the CEC report. Based on the estimated outdoor water demand, these energy intensity factors, and the utility-specific carbon intensity factor, GHG emissions from outdoor water treatment and distribution may be calculated.

The sum of emissions due to supplying, conveying, treating, and distributing outdoor water gives the total emissions due to outdoor water use.

5.5.2.1 Landscape Watering – Turf Grass

The amount of outdoor water used in the landscape watering of turf grass is calculated based on the California Department of Water Resources (CDWR) 2009 Model Water Efficient Landscape Ordinance[27] and the CDWR 2000 report "A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III."[28] Using this methodology, the amount of water required to support the baseline turf water demand ($Water_{baseline}$) is calculated as follows:

$$ETC = Kc \times ET_0$$

Where:

ETC	=	Crop Evapotranspiration, the total amount of water the baseline turf loses during a specific time period due to evapotranspiration[29] (inches water/day)
KC	=	Crop Coefficient, factor determined from field research, which compares the amount of water lost by the crop (e.g. turf) to the amount of water lost by a reference crop (unitless). Species-specific; provided in CDWR 2000
ET_0	=	Reference Evapotransporation, the amount of water lost by a reference crop (inches water/day) Region-specific; provided in Appendix A of CDWR 2009

[27] California Department of Water Resources. 2009. Model Water Efficient Landscape Ordinance. Available online at: http://www.water.ca.gov/wateruseefficiency/docs/MWELO09-10-09.pdf

[28] California Department of Water Resources. 2000. A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California: The Landscape Coefficient Method and WUCOLS III. Available online at: http://www.water.ca.gov/pubs/conservation/a_guide_to_estimating_irrigation_water_needs_of_landscape_plantings_in_california__wucols/wucols00.pdf

[29] Evapotranspiration is water lost to the atmosphere due to evaporation from soil and transpiration from plant leaves. For a more detailed definition, see this California Irrigation Management Information System (CIMIS) website: http://wwwcimis.water.ca.gov/cimis/infoEtoOverview.jsp;jsessionid=91682943559928B8A9A243D2A2665E19

Then:

$$\text{Water}_{baseline} = \text{ETC x Areabaseline X 0.62 x 365}$$

Where:

$\text{Water}_{baseline}$	=	Volume of water required to support the baseline turf (gallons/year)
$\text{Area}_{baseline}$	=	Area of existing or standard turf (square feet)
0.62	=	conversion factor (gallons/squarefoot.inches water)
365	=	conversion factor (days/year)

Based on the estimated outdoor water demand for watering turf grass, the outdoor water energy intensity factors described above, and the utility-specific carbon intensity factor, GHG emissions from watering turf grass in lawns may be calculated.

5.5.2.2 Landscape Watering – General

The amount of outdoor water used in the landscape watering of landscapes and lawns is calculated based on the California Department of Water Resources (CDWR) 2009 Model Water Efficient Landscape Ordinance.[30] Using this methodology, the amount of water required to support the baseline lawn water demand ($\text{Water}_{baseline}$) is defined as the Maximum Applied Water Allowance (MAWA) and is calculated as follows:

$$\text{Water}_{baseline} = \text{MAWA} = \text{ET}_0 \text{ x } 0.62 \text{ x } [(0.7 \text{ x LA}) + (0.3 \text{ x SLA})]$$

Where:

$\text{Water}_{baseline}$	=	Volume of water required to support the baseline lawn (gallons/year)
MAWA	=	Maximum Applied Water Allowance (gallons/year)
ET_0	=	Annual Reference Evapotranspiration[31] from Appendix A of CDWR 2009 (inches per year)
0.7	=	ET Adjustment Factor (ETAF)
LA	=	Landscape Area[32] includes Special Landscape Area[33] (square feet)

[30] California Department of Water Resources. 2009. Model Water Efficient Landscape Ordinance. Available online at: http://www.water.ca.gov/wateruseefficiency/docs/MWELO09-10-09.pdf

[31] Evapotranspiration is water lost to the atmosphere due to evaporation from soil and transpiration from plant leaves. For a more detailed definition, see this California Irrigation Management Information System (CIMIS) website: http://wwwcimis.water.ca.gov/cimis/infoEtoOverview.jsp;jsessionid=91682943559928B8A9A243D2A2665E19

[32] § 491 Definitions in CDWR 2009: "Landscape Area (LA) means all the planting areas, turf areas, and water features in a landscape design plan subject to the Maximum Applied Water Allowance calculation. The landscape area does not include footprints of buildings or structures, sidewalks, driveways, parking lots, decks, patios, gravel or stone walks, other pervious or non-pervious hardscapes, and other non-irrigated areas designed fro non-development (e.g., open spaces and existing native vegetation)."

[33] § 491 Definitions in CDWR 2009: "Special Landscape Area (SLA) means an area of the landscape dedicated

0.62	=	Conversion factor (to gallons per square foot)
SLA	=	Portion of the landscape area identified as Special Landscape Area (square feet)
0.3	=	the additional ETAF for Special Landscape Area

Based on the estimated outdoor water demand for watering lawns, the outdoor water energy intensity factors described above, and the utility-specific carbon intensity factor, GHG emissions from watering lawns may be calculated.

5.5.3 Recycled Water

After use, wastewater is treated and reused as reclaimed water. Any reclaimed water produced is generally redistributed to users via pumping. An estimate of the non-potable water demand to be met through the distribution of recycled water is needed. Estimates of the amount of energy needed to redistribute and, if necessary, treat reclaimed water is 400 kW-hr per acre foot.[34] Based on the estimated demand for reclaimed water, the estimated electricity demand and the utility-specific carbon-intensity factor, non-potable reclaimed water redistribution emissions are calculated.

5.5.4 Process

Industrial land uses can use a large amount of water for their processes. The water used for this will not be quantified since there is not sufficient water use data for this type of land use for the development of a default value. Water use is highly dependent on the specific industry..

5.6 Wastewater

Emissions associated with wastewater treatment include indirect emissions necessary to power the treatment process and direct emissions from degradation of organic material in the wastewater.

5.6.1 Direct Emissions

Direct emissions from wastewater treatment include emissions of CH_4 and biogenic CO_2. The method described by the Local Government Operations Protocol developed by the California Air Resources Board is suggested with default values assigned since detailed plant specific data will typically not be available.[35] The assumed daily 5-day carbonaceous biological oxygen

solely to edible plants, areas irrigated with recycled water, water features using recycled water and areas dedicated to active play such as parks, sports fields, golf courses, and where turf provides a playing surface."

[34] CEC 2005. California's Water-Energy Relationship. Final Staff Report. CEC-700-2005-011-SF.

[35] California Air Resources Board. 2008. *Local Government Operations Protocol - for the quantification and reporting of greenhouse gas emissions inventories*. Version 1.0. September 2008. Developed in partnership by California Air Resources Board, California Climate Action Registry, ICLEI - Local Governments for Sustainability, The Climate Registry

demand (BOD_5) of 200 mg/L-wastewater is multiplied by the protocol defaults for maximum CH_4-producing capacity (0.6 kg-CH_4/kg-BOD_5) and other default values to obtain the direct CH_4 emission. The amount of digester gas produced per volume of wastewater, and amount of N_2O per volume of wastewater needs to be determined. These values are then multiplied by the Global Warming Potential factor[36] of 21 for CH_4 or 310 for the GWP of N_2O that would be generated otherwise to obtain the annual CO_2 equivalent emissions.

5.6.2 Indirect Emissions

Indirect GHG emissions result from the electricity necessary to power the wastewater treatment process. The electricity required to operate a wastewater treatment plant is estimated to be 1,911 kW-hr per million gallons.[37] Based on the expected amount of wastewater requiring treatment, which will be assumed to be equal to the indoor potable water demand absent other data, the energy intensity factor and the utility-specific carbon-intensity factor, indirect emissions due to wastewater treatment are calculated.

5.7 Public Lighting

Lighting sources contribute to GHG emissions indirectly, via the production of the electricity that powers these lights. Lighting sources considered in this source category include streetlights, traffic lights, and parking lot lights. The annual electricity use may be estimated using the number of heads, the power requirements of each head, and the assumption that they operate for 12 hours a day on average for 365 days per year or 24 hours for traffic lights. The emission factor for public lighting is the utility-specific carbon-intensity factor. Multiplying the electricity usage by the emission factor gives an estimate of annual CO_2e emissions from public lighting.

5.8 Municipal Vehicles

GHG emissions from municipal vehicles are due to direct emissions from the burning of fossil fuels. Municipal vehicles considered in this source category include vehicles such as police cars, fire trucks, and garbage trucks. Data from reports by Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, California[38] show that the CO_2 emissions from municipal

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[36] Intergovernmental Panel on Climate Change. IPCC Second Assessment - Climate Change 1995.

[37] CEC 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.

[38] City of Medford. 2001. Climate Action Plan. October. http://www.massclimateaction.org/pdf/MedfordPlan2001.pdf

City of Northampton. 2006. Greenhouse Gas Emissions Inventory. Cities for Climate Protection Campaign. June. http://www.northamptonma.gov/uploads/listWidget/3208/NorthamptonInventoryClimateProtection.pdf

City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf

Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives. October.http://www.ci.duluth.mn.us/city/information/ccp/GHGEmissions.pdf vehicles would be approximately[39] 0.05 MT per capita per year. Using these studies and the expected population, emissions from municipal vehicles may be calculated.

5.9 On-Road Mobile Sources

This section estimates GHG emissions from on-road mobile sources. The on-road mobile source emissions considered a project will be from the typical daily operation of motor vehicles by project residents and non-residents. The GHG emissions based upon all vehicle miles traveled associated with residential and non-residential trips regardless of internal or external destinations or purpose of trip are estimated. Traffic patterns, trip rates, and trip lengths are based upon the methods discussed below.

The CCAR GRP[40] recommends estimating GHG emissions from mobile sources at an individual vehicle level, assuming knowledge of the fuel consumption rate for each vehicle as well as the miles traveled per car. Since these parameters are not known for a future development, the CCAR guidance can not be used as recommended.

Estimating Trip Rates

The majority of transportation impact analysis conducted for CEQA documents in California apply trip generation rates provided by the Institute of Transportation Engineers (ITE) in their regularly updated report *Trip Generation*. The report is based on traffic counts data collected over four decades at built developments throughout the United States. This data is typically based on single-use developments, in suburban locations with ample free parking and with minimal transit service and demand management strategies in place. As a result, the ITE trip generation rates represent upper bound trip generation rates for an individual land use type. This represents a good basis against which to measure the trip-reducing effects of any one or more of the mitigation strategies that will be quantified in subsequent tasks. Therefore, we recommend ITE trip rates as the baseline condition against which the effectiveness of CAPCOA's mitigation measures is applied.

There are some CEQA traffic studies that use data other than ITE trip generation rates. Below we briefly discuss the possible use of these alternative datasets. These traffic studies typically use trip generation data from one of the following sources:

*SANDAG Traffic Generators***.** In the San Diego region, most studies use data from the SANDAG *Traffic Generators* report. This report is similar to the ITE *Trip Generation* in that it uses primarily suburban, single use developments, except that this dataset is based on traffic counts conducted in the San Diego region rather than throughout the United States. In studies where the SANDAG data is used, CAPCOA reviewers should apply the trip reduction estimates presented in subsequent tasks directly to the SANDAG trip generation rates.

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[39] In an effort to be conservative, the largest per capita number from these four reports was used.

[40] California Climate Action Registry (CCAR). 2009. *General Reporting Protocol*. Version 3.1. January.

Travel Forecast Models. For some large development projects or general plans, the local or regional travel model is used to estimate the number of trips generated as well as trip lengths and vehicle speeds at which the individual trips occur. These models account for whether the trip segment occurs on a freeway or local streets as well as the degree of congestion. The values for trip generation rates and trip lengths using ITE and average trip lengths can be to assess the model estimates of vehicle trip generation and VMT. These comparisons should recognize that the travel models explicitly account for various factors that reduce trip-making and VMT, including the demographic characteristics of the site occupants, location and accessibility of the development site relative to other destinations in the region, the mix of land uses within the site and its surrounding area, and possibly the availability of effective transit service. When performing a comparison using the ITE trip rates and average trip lengths, the reviewer should take into consideration that these factors have already been accounted for in the modeling. Therefore, we recommend applying ITE trip rates and lengths along with the adjustments recommended elsewhere in this document (accounting for site location, design and demographics) as a means of reality-checking transportation model results.

Traffic counts at comparable developments. Some traffic assessments elect to conduct traffic counts at existing developments that are similar to the proposed development. When reviewing impact assessments produced using such information, the reviewer should take into account the extent to which the surveyed development(s) already contain trip generation and trip length reducing measures. Care needs to be used to avoid double-counting reductions.

Estimating VMT from Mobile Sources

Data on average trip lengths are used to translate trip generation rates into vehicle miles of travel (VMT). These trip lengths should be obtained from published sources of average trip lengths for different types of trip types (i.e., commute trips, shopping trips, and others) for each region within the state. Vehicle miles traveled (VMT) are calculated by multiplying ITE trip rates by the typical trip lengths.

Some mechanisms that reduce trip generation rates and trip lengths below these standard ITE-trip rates and current average trip lengths might be considered to be intrinsic parts of the development proposal rather than mitigation measures, such as project location (e.g., infill or transit oriented development [TOD]), density, mix of uses, and urban design. These are not considered part of the baseline condition, but are recognized and quantified as project design features (PDFs). This approach has the following advantages: 1) it creates a consistent basis of analysis for all development projects regardless of location and self-mitigating features already included in the project proposal, and 2) it highlights all elements of a project that reduce trip generation rates and vehicle miles traveled.

Other Factors Influencing Mobile Source GHG Emissions

Beyond trip generation, trip length and VMT, other factors that affect GHG emissions include traffic flow, vehicle fuel consumption rates, and fuel type.

Traffic speed and efficiency profiles are largely influenced by: a) the project location and degree of prevailing congestion in its vicinity, b) the degree to which the project implements traffic level-of-service mitigation measures often triggered by CEQA review, and c) actions taken by local, regional governments and Caltrans to reduce corridor or area-wide congestion.

The simplified mitigation assessment methods developed for this study use several categories of emissions factors per VMT that account for a) the generalized project location (core infill, inner ring suburbs, outer suburbs, rural), and b) and region-specific fleet and emissions rate if available.

While it is beyond the scope of this document to provide CAPCOA the ability to perform traffic speed and efficiency analysis, the study report advises CAPCOA on the type of analysis to expect to see in CEQA documents on development projects. CEQA impact and mitigation assessment methods should continue to perform air quality analysis using tools such as EMFAC that reference prevailing traffic speed profiles, especially for infill development and congested corridors, while applying appropriate credit for congestion reducing measures included in the project mitigation requirements, funded capital improvements plans, and fiscally constrained Regional Transportation Plans (RTPs.)

5.9.1 Estimating GHG Emissions from Mobile Sources

The CO_2 emissions from mobile sources were calculated with the trip rates, trip lengths and emission factors for running and starting emissions from EMFAC2007 as follows:

$$CO_2\ emissions = VMT \times EF_{running}$$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = emission factor for running emissions

The CO_2e calculation involves the following assumptions:

- The emission factor depends upon the speed of the vehicle.
- EMFAC emission factors from the baseline year will be used for $EF_{running}$ based on County specific fleet mix for different trip types and adjusted to account for applicable regulations that are not currently incorporated yet into EMFAC.

Startup emissions are CO_2 emitted from starting a vehicle. Startup emissions are calculated using the following assumptions:

- The number of starts is equal to the number of trips made annually.
- The breakdown in vehicles is EMFAC fleet mix for County specific fleet mix.
- The emission factor for startup is calculated based on a weighted average of time between starts for each trip type (commute trips versus all other types).

Fleet distribution types will be based on EMFAC2007 or the most recent EMFAC version available. For mobile sources, the USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[41] To incorporate these additional GHGs into the calculations, the total GHG footprint is calculated by dividing the CO_2 emissions by 0.95.

Emission factors for alternative fuel can be obtained from the CCAR General Reporting Protocol. For comparison with alternative fuel, N_2O and CH_4 emissions should be calculated separately as their emissions from alternative fuel are generally higher than from gasoline or diesel.

Low-emission-vehicle programs, such as neighborhood electric vehicles (NEV) or car sharing programs, will only be considered in accounting for GHG reductions if included in project-specific design or mitigation measures.

5.10 GHG Emissions from Specialized Land Uses

Below are methods to quantify GHG emissions from some additional land use categories that may be commonly found in development projects. These include golf courses and swimming pools. The methods proposed to determine GHG emissions associated with these sources is discussed in the following sections. The GHG emissions will typically fall into other categories such as landscape maintenance, water usage, and buildings, but since the data sources are different, they are explicitly described.

5.10.1 Golf Courses

Emission flux resulting from the construction of the golf course is not discussed, nor is the sequestration of CO_2 into the turf, trees, or lakes of the golf course. Operational CO_2 emissions were calculated for three areas: irrigation, maintenance (mowing), and on-site buildings' energy use. All three components are discussed in this section.

5.10.2 Calculating CO_2 Emissions from Irrigation of the Golf Course

The release of GHGs due to irrigation practices was calculated in two steps:

1. Identify the quantity of water needed.

2. Calculate the emissions associated with pumping the water.

1. *Identify the quantity of water needed.* Standard water use for an 18-hole golf course ranges from 250 to 450 acre-ft yearly. A survey of golf course superintendents conducted in the summer of 2003 by the Northern and Southern California Golf Associations revealed an annual average California usage of 345 acre-ft.[42] Numerous factors will affect the actual water usage

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[41] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February.

[42] Northern California Golf Association. Improving California Golf Course Water Efficiency, pg 14. http://www.owue.water.ca.gov/docs/2004Apps/2004-079.pdf

of a specific golf course, and it is likely to vary by year. ENVIRON recommends using the average usage of 345 acre-ft per year annually.

2. Calculate the associated emissions. Using the information identified above, ENVIRON calculates total emissions from irrigation of an 18-hole golf course as follows:

Estimate total dynamic head: This is the combination of lift (300 feet) and desired pressure. Standard athletic field sprinklers require a base pressure of approximately 65 psi.[43]

$$\begin{array}{lcl} \textit{60 psi x 2.31 ft/psi}^{44} & = & \textit{139 ft} \\ \underline{\textit{+ lift}} & \underline{=} & \underline{\textit{300 ft}} \\ \textit{Total dynamic head} & = & \textit{439 ft} \end{array}$$

Identify fuel unit and multiply by head: Possible pumping fuels include electricity, natural gas, diesel, and propane. In these calculations, ENVIRON assumes that all pumps will use electricity. Based on the literature, ENVIRON recommends using a pumping energy use of 1.551 kW-hr/acre-ft/ft.[45]

$$1.551 \text{ kW-hr/acre-ft/ft} \quad x \quad 439 \text{ ft} \quad = \quad 681 \text{ kW-hr/acre-foot}$$

Multiply energy demand by emission factor and convert to MT: The energy demand per acre-ft calculated above is multiplied by the emission factor for the electricity generation source and converted to MT.

$$\frac{681\text{kW-hr/acre-ft x } 0.666 \text{ lbs } CO_2\text{/kW-hr}}{2204.62 \text{ lbs/ton}} = 0.21 \text{ MT } CO_2\text{/acre-ft}$$

The anticipated annual water demand will be multiplied by these values and then combined this with the calculated emission factor yields total annual emissions from irrigation of the golf course. Other outdoor land uses that require irrigation can follow a similar procedure.

5.10.3 Calculating CO_2 Emissions from Maintenance of the Golf Course

Maintenance emissions include the emissions resulting from the mowing of turf grass. The release of GHGs due to mowing was calculated in three steps:

1. Identify the area of turf and frequency of mowing.
2. Identify the efficiency of a typical mower.

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[43] Full Coverage Irrigation. Partial List of Customers Using FCI Nozzles. http://www.fcinozzles.com/clients.asp.

[44] Conversion factor: 1 psi = 2.31 feet of head. Kele & Associates Technical Reference: Liquid Level Measurement. http://www.kele.com/tech/monitor/Pressure/LiqLevMs.pdf

[45] Kansas State University Irrigation Management Series. Comparing Irrigation Energy Costs. Table 4. http://www.oznet.ksu.edu/library/ageng2/mf2360.pdf

3. Calculate the emissions associated with mowing.

1. *Identify the area of turf and frequency of mowing*: An Arizona State economic analysis of golf courses reports that on average 2/3 of the land within a golf course is maintained.[46] ENVIRON suggests assuming that the course will be mowed twice weekly, although high maintenance areas such as greens will be mowed more frequently.[47] ENVIRON recommends a growing season of 52 weeks/year.[48]

2. *Identify the efficiency of a typical mower*. Typical mower calculations are based on the specifications for a lightweight fairway mower (model 3235C) reported by John Deere's Golf & Turf division.[49] A typical mower will use one tank (18 gallons) of diesel per day (assumed to be 8 hours). Given the size specifications of the mower and assuming an average speed of 5.5 mph, such a mower can cover 44 acres on 18 gallons of diesel.

3. *Calculate the emissions associated with mowing*. Using the information collected above and a CO_2 emission factor for diesel combustion[50], ENVIRON calculates the emission factor for mowing the golf course:

$$\frac{2 \text{ mowings}}{\text{week}} \times \frac{52 \text{ weeks}}{\text{year}} \times \frac{18 \text{ gallons diesel}/}{44 \text{ acre-mowing}} \times \frac{22.4 \text{ lbs } CO_2/ \text{ gallon diesel}}{2204 \text{ lbs/ton}} = 0.43 \text{ MT } CO_2/\text{acre-year}$$

5.10.4 Calculating CO_2 Emissions from Building Energy Use at the Golf Course

Any of the non-residential building energy use data sources described in the Buildings section may be used to estimate energy intensity at the golf course.

5.11 Pools

Recreation centers may include various pools, spas, and restroom buildings; ENVIRON assumes that pools are the main consumers of energy in recreation centers. This section describes the methods used to estimate the GHGs associated with pools in recreation centers.

The energy used to heat and maintain a swimming pool depends on several factors, including (but not limited to): whether the pool is indoors or outdoors, size of the pool (surface area and depth), water temperature, and energy efficiency of pool pump and water heater, and whether

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[46] Total acreage divided by total acreage maintained. Arizona State University, Dr. Troy Schmitz. Economic Impacts and Environmental Aspects of the Arizona Golf Course Industry. http://agb.poly.asu.edu/workingpapers/0501.pdf.

[47] Based on Best Practices video. http://buckeyeturf.osu.edu/podcast/?p=51

[48] Based on 95% of Southern California Survey respondents report an irrigation season greater than 9-10 months. http://www.owue.water.ca.gov/docs/2004Apps/2004-079.pdf

[49] John Deere Product Specifications. 3235C Lightweight Fairway Mower. http://www.deere.com/en_US/ProductCatalog/GT/series/gt_lwfm_c_series.html

[50] EIA. Fuel and Energy Source Codes and Emission Coefficients. http://www.eia.doe.gov/oiaf/1605/factors.html

solar heating is used. By making assumptions for these parameters and using known or predicted values for energy use, ENVIRON estimates the electricity and natural gas use of an outdoor pool.

5.11.1 Recreation Center Characterization

In the calculations described below, ENVIRON assumes that the proposed pools will be outdoor pools with dimensions 50 meters by 22.9 meters (a typical, competition-size pool). ENVIRON bases electricity calculations on a pool that ran its standard water filter for 24 hours per day, 365 days per year. As there is little data publicly available on the energy use of commercial swimming pools, ENVIRON extrapolates energy consumption from information obtained from two sources: 1) Data on electricity used by pool pumps from Pacific Gas and Electric (PG&E),[51] and 2) Data on the annual cost to heat a commercial pool located in Carlsbad, CA.[52]

5.11.2 Electricity Use of Pools

A PG&E study on energy efficiency of a pool pump at the Lyons Pool in Oakland, CA, found an annual electricity use of 110,400 kilowatt hours per year (kWh per yr).[53] The study pool is smaller than the assumed size of the proposed pool (actual size of the Lyons Pool is 35 yards by 16 yards). Accordingly, ENVIRON scales the electricity use to reflect the larger size of the proposed pool.

5.11.3 Natural Gas Use of Pools

The estimated annual cost of heating a standard competition-size pool is $184,400 (or 72% of the total cost of pool operations).[54] ENVIRON used the average PG&E commercial rate for natural gas of $0.95 per therm to convert this cost into annual natural gas use (hundred cubic feet per year [ccf/year]).[55] The commercial rate averages the variable cost due to energy usage and time of year. This corresponds to approximately 184,400 ccf per year.[56]

This value is comparable to that obtained from the pool industry.[57] The estimated cost of heating a residential pool using a natural gas heater is about one dollar per square foot of water

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[51] PG&E. 2006. Energy Efficient Commercial Pool Program, Preliminary Facility Report. Lyons Pool, "City of Oakland/Oakland Unified School District." October.

[52] Mendioroz, R. 2006. Fueling Change: A Number of Design Schemes and Alternative-Energy Strategies Can Help Operators Beat the Price of Natural Gas. Athletic Business. March.

[53] PG&E. 2006. Energy Efficient Commercial Pool Program, Preliminary Facility Report. Lyons Pool, "City of Oakland/Oakland Unified School District." October.

[54] Mendioroz, R. 2006. Fueling Change: A Number of Design Schemes and Alternative-Energy Strategies Can Help Operators Beat the Price of Natural Gas. Athletic Business. March.

[55] Pacific Gas and Electric (PG&E). 2007. Gas Rate Finder. Vol 36-G, No. 9. September. http://www.pge.com/tariffs/GRF0907.pdf

[56] At the commercial rate given 1 ccf costs $1.

[57] SolarCraft Services Inc. 2007. Phone conversation with Chris Bumas on September 18, 2007. Novato, CA http://www.solarcraft.com/

surface area per month ($/sqft-month) in residential therms.[58] Applying this value to a competition-size pool yields an annual natural gas use of 147,600 ccf/year.

5.11.4 Conversion of Electricity and Natural Gas Use to Greenhouse Gas Emissions

ENVIRON used utility-specific electricity and natural gas emission factors to calculate the total CO_2 emissions for each pool. A summary of the calculations is shown below:

$$Emissions\ from\ Electricity\left(\frac{Tonnes\ CO_2\ /\ yr}{1{,}000\, sqft}\right) =$$
$$\frac{Energy\ Use\ (ccf\ /\ yr) \times Emission\ Factor\ (lbs\ CO_2e\ /\ ccf) \times Conversion\ Factor\ (tonne\ /\ 2205\ lbs)}{Surface\ Area\ of\ Pool\ (1{,}000\ sqft)}$$

$$Emissions\ from\ Natural\ Gas\left(\frac{Tonnes\ CO_2\ /\ yr}{1{,}000\, sqft}\right) =$$
$$\frac{Energy\ Use\ (ccf\ /\ yr) \times Emission\ Factor\ (lbs\ CO_2e\ /\ ccf) \times Conversion\ Factor\ (tonne\ /\ 2205\ lbs)}{Surface\ Area\ of\ Pool\ (1{,}000\ sqft)}$$

[58] The residential price for one therm of natural gas.

Appendix C

Transportation Appendices

Appendix C.1

Transportation Calculations

Appendix C.1 – Transportation Calculations

Table C-1 provides further detail into the calculations of percent reduction in vehicle miles traveled (VMT) for each of the fact sheets (that have references to the appendix). Many of the strategies in the table below do not provide the full equations for percent reduction in vehicle miles traveled. Only the equations or variables which require further detail are outlined here. The table also provides detail on any assumptions which are made to perform the calculations and the basis of such assumptions. An additional section below Table C-1 provides a detailed discussion of the calculations made for the transit accessibility strategy.

Table C-1
Transportation Calculations

Strategy	T#	Equation	Variable	Value	Source/Notes
Increase Density (Land Use/Location)	A2	A = Percentage increase in housing units per acre = (number of housing units per acre – number of housing units per acre for typical ITE development) / (number of housing units per acre for typical ITE development)	number of housing units per acre for typical ITE development	7.6 = blended average density of residential development in the US in 2003	A.C. Nelson. "Leadership in a New Era." *Journal of the American Planning Association,* Vol. 72, Issue 4, 2006, pp. 393-407 – as cited in *Growing Cooler*
		A = Percentage increase in jobs per job acre = (number of jobs per job acre – number of jobs per job acre for typical ITE development) / (number of jobs per job acre for typical ITE development)	number of jobs per job acre for typical ITE development	20 = average jobs per job acre	Year 2005 Land Use, Sacramento County Travel Demand Model, 2008
Improve Design of Development (Land Use/Location)	A3	A = Percentage increase in intersections versus a typical ITE suburban development = (intersections per square mile of project – intersections per square mile of typical ITE suburban development) / (intersections per square mile of typical ITE suburban development)	intersections per square mile of typical ITE suburban development	36 = ITE site average intersection density	Based on Fehr & Peers methodology for analysis in the report: *Proposed Trip Generation, Distribution, and Transit Mode Split Forecasts for the Bayview Waterfront Project Transportation Study*, Fehr & Peers, 2009

Table C-1
Transportation Calculations

Strategy	T#	Equation	Variable	Value	Source/Notes
Increase Diversity (Mixed Use) (Land Use/Location)	A5	A = Percentage increase in land use index versus single use development = (project land use index – single land use index) / single land use index	single land use index	0.15 = - [1*(ln 1) + 0.01*(ln 0.01)+…+0.01*(ln 0.01)]/ ln(6)	--
Increase Destination Accessibility (Land Use/Location)	A6	A = Percentage decrease in distance to downtown or major job center = (distance to downtown/job center for typical ITE development – distance to downtown/job center for project) / (distance to downtown/job center for typical ITE development)	distance to downtown/job center for typical ITE development	12 miles (average work trip length from NHTS)	2000-2001 California Statewide Travel Survey, 2001 NHTS Summary of Travel Trends, p.15 (Table 5)
Increase Transit Accessibility (Land Use/Location)	A7	A = Increase in transit mode share = % transit mode share for project - % transit mode share for typical ITE development	% transit mode share for typical ITE development	1.3%	NHTS, 2001 http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_StwTravelSurveyWkdayRpt.pdf, p.150 (Suburban – SCAG, SANDAG, Fresno County.)
		B = Adjustment from transit mode share to VMT = 1 / average vehicle occupancy * conversion from VT to VMT = 0.67	Divide by average vehicle occupancy to translate to VT	1 / average vehicle occupancy = 1 / 1.5 = 0.67	NHTS, http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/2000_Household_Survey.pdf, p.iii
			conversion from VT to VMT	1	Assume all trip lengths are equal (vehicle trips to VMT) [1]

[1] To convert to vehicle miles traveled, we assume that all vehicle trips will average out to typical trip length ("assume all trip lengths are equal"). Thus, we can assume that a percentage reduction in vehicle trips will equal the same percentage reduction in vehicle miles traveled.

Table C-1
Transportation Calculations

Strategy	T#	Equation	Variable	Value	Source/Notes
Unbundle Parking Cost from Property Cost (Parking Pricing/Policy)	C3	A = Adjustment from Vehicle Ownership to VMT = average trips per 2 vehicles * 1 vehicle per average trips =(9.8 trips/ 2 vehicles) * (1 vehicle / 5.7 trips) = 0.85	Average trips per X vehicles	Households with 2 vehicles take 9.8 trips while households with 1 vehicle take 5.7 trips per day	i.e. A reduction of 1 vehicle leads to an 0.85 reduction in vehicle trips http://www.dot.ca.gov/hq /tsip/tab/documents/travel surveys/2000_Household _Survey.pdf, table 8.7
Expand Transit Network (Transit System Improvements)	D2	D = Adjustment for Transit Ridership Increase to VMT	--	0.67	see Increase Transit Accessibility
Enhance Transit Service Frequency/Speed (Transit System Improvements)	D3	E = Adjustment for Transit Ridership Increase to VMT	--	0.67	see Increase Transit Accessibility
Implement Bus Rapid Transit (Transit System Improvements)	D4	D = Adjustment for Transit Ridership Increase to VMT	--	0.67	see Increase Transit Accessibility
Implement Required Trip Reduction Programs (Trip Reduction Programs)	E2	C = Adjustment from vehicle mode share to commute VMT	--	1	Assume all trip lengths are equal (vehicle mode share to vehicle trips to VMT) [i]
Provide a Transit Fare Subsidy (Trip Reduction Programs)	E3	C = Adjustment from commute VT to commute VMT	--	1	Assume all trip lengths are equal (vehicle trips to VMT) [i]
Implement Commute Trip Reduction Marketing (Trip Reduction Programs)	E7	C = Adjustment from commute VT to commute VMT	--	1	Assume all trip lengths are equal (vehicle trips to VMT) [i]

Table C-1
Transportation Calculations

Strategy	T#	Equation	Variable	Value	Source/Notes
Provide Employer-Sponsored Vanpool/Shuttle (Trip Reduction Programs)	E8	C = Adjustment from vanpool mode share to commute VMT	--	0.67	see Increase Transit Accessibility
Implement Bike-Sharing Programs (Trip Reduction Programs)	E10	% VMT Reduction = A * B * C = 2% * 7% * 20% = 0.03%	--	--	--
		A = 2% = Net new bicycle mode share = (existing mode share * % increase in bicycle mode share) – existing mode share	Existing mode share	Estimate at 1%	Pucher et al., 2010
			% increase in bicycle mode share	135 – 300%	Pucher et al., 2010, Table 4 (see fact sheet for calculations)
		B = % of new bicycle trips shifting from vehicles (from literature)	--	6-7%	Pucher et al., 2010 and Bike-Share in NYC, 2009, Table 4, p.45
		C = adjustments to convert from vehicle mode share to VMT * adjustment for shorter than average trip lengths = 1*20%	adjustments to convert from vehicle mode share to VMT	1	Assume all trip lengths are equal (vehicle mode share to vehicle trips to VMT) [i]
			adjustment for shorter than average trip lengths	1.94/9.9 = 20%	Adjustment to reflect ratio of bike trip length to average trip length (this strategy will only replace the shorter vehicle trips that can be reasonably replaced by a bicycle). [1.94 miles (average bike trip length from Moving Cooler Appendices B-28 referencing NHTS) / 9.9 miles (average household trip length from NHTS Transferability, 2001 NHTS, http://nhts-gis.ornl.gov/transferability/Default.aspx)]

Table C-1
Transportation Calculations

Strategy	T#	Equation	Variable	Value	Source/Notes
Provide End of Trip Facilities (Trip Reduction Programs)	E11	*utilizing the same equation in bike sharing program section, set A = 1.3% = (7.1% - 5.8%) % VMT Reduction = A * B * C = 1.3% * 7% * 20% = 0.02%	--	--	--
Establish Schoolpool (Trip Reduction Programs)	E13	B = Adjustments to convert from participation to daily VMT to annual school VMT = [(avg # of families per carpool - 1) / avg # of families per carpool] *% of school days	avg # of families per carpool	2.5	TDM Case Studies, DRCOG, p.13
			% of school days	75% = 39 school weeks/ 52 weeks	TDM Case Studies, DRCOG, p.13
Provide School Buses (Trip Reduction Programs)	E14	B = Adjustments to convert from participation to daily VMT to annual school VMT = % of school days	% of school days	75% = 39 school weeks/ 52 weeks	TDM Case Studies, DRCOG, p.13
Cordon Pricing (Road Pricing Management)	F2	A = % increase in pricing for passenger vehicles to cross cordon	--	100 – 500%	*Moving Cooler* uses peak hour price per mile instead of crossing price. The percentage change can still be calculated to provide a general estimate for a high range % change. Assuming a baseline of $0.10, calculated percentage increase to $0.49 - $0.65 (*Moving Cooler*) and adjusted with rounding
		C = % of VMT Impacted by Cordon Pricing and Mode Shift Adjustments = %VMT impacted by congestion pricing * Mode shift adjustment = 8.8% (peak period) and 21% (all day)	--	--	--

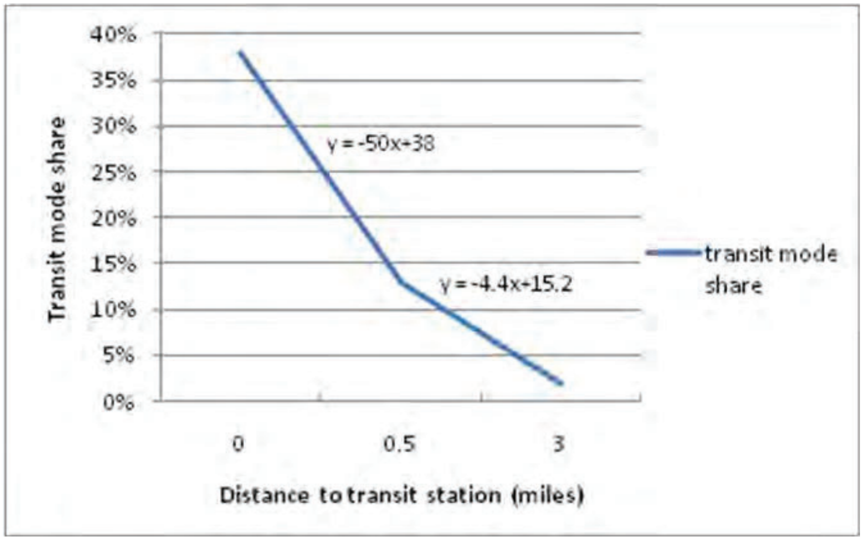
Table C-1
Transportation Calculations

Strategy	T#	Equation	Variable	Value	Source/Notes
		Peak period = 25% * 35% = 8%	%VMT impacted by congestion pricing	25%	20% of trips are work trips (NHTS Transferability, 2001 NHTS, http://nhts-gis.ornl.gov/transferability/Default.aspx) and round up assuming other trips travel during peak periods
			Mode shift adjustment	35% = 20% + 30%/2	Of the estimated trips affected to the increase in price, assume 50% is either a time of day shift/route shift/no change, 30% convert to HOV trips (with average 2 ppl per HOV), and 20% are trip reductions/shift to transit, walk or bike
		Static all day price (London) = 60% * 35% = 21%	% VMT impacted by congestion pricing	60%	Conservatively assume 60% of trips fall in the peak periods and mid-day
			Mode shift adjustment	35%= 20% + 30%/2	Of the estimated reduced trips due to the increase in price, assume 50% is either a time of day shift/route shift/no change, 30% convert to HOV trips (with average 2 people per HOV), and 20% are trip reductions/shift to transit, walk or bike

<u>Increase Transit Accessibility (Land Use/Location)</u>

Distance to transit	Transit mode share calculation equation (where x = distance of project to transit)
0 – 0.5 miles	-50*x + 38

0.5 to 3 miles	-4.4*x + 15.2
> 3 miles	no impact
Source: Lund et al, 2004; Fehr & Peers 2010	



Data was taken from Table 5-25 of Lund et al, 2004. The table provided transit commute mode shares for those living with ½ mile of a rail station for 5 sites surveyed within California. Removing the extreme low and high percentages, this provided a range of transit commute mode share of 13% to 38%. A simple linear extrapolation was conducted to provide a relationship for distance to transit (between 0 and ½ mile) to transit mode share, via the equation: transit mode share = -50 * distance to transit + 38. The table also provided transit mode shares for those living from ½ to 3 miles from a station, a range from 2% to 13%. Using the same methodology, a relationship for distance to transit (between ½ mile and 3 miles) to transit mode share is provided via the equation: transit mode share = -4.4x + 15.2.

Appendix C.2

Trip Adjustment Factors

Appendix C.2 – Trip Adjustment Factors

The trip adjustment factors are not explicitly used for calculations of reduction in vehicle miles traveled (VMT) but serve as an added resource point for users of this document. For example, we report all commute trip reduction (CTR) program strategies as a percentage reduction in commute VMT. If the user would like to translate this to project level VMT (assuming the project is NOT an office park), and the user does not have statistics about the project area readily available, then the trip adjustment factors table can be utilized.

Example: Assume the user is providing a 15% reduction in commute VMT for a implementation of a ride share program. To calculate an estimated reduction in project level VMT, the user can multiple 15% by 20% (NHTS average % of work trips) and again multiply by 12.0 / 9.9 (average work trip length/average trip length) to adjust for both the portion of trips which are work related and that work trips tend to be longer than average trips.

TABLE C-2. TRIP ADJUSTMENT FACTORS

	NHTS[1]	Sacramento Region[2]	San Diego Region [3]	Rural (Kings County, CA) [4]
Average Work Trip Length (vehicle)	12.0	10.4	8.4	-
Average Trip Length (vehicle)	9.9	6.8	6.9	8.7
Average % of Work Trips	20%	20%	-	12%
Average % of School Trips	9.8%	-	-	-
Average Length of School Trips (Vehicle)	6.0	-	4.2	-
Average Vehicle Occupancy (All Trips)	1.5	1.4	1.5	-

Source:
1. 2000-2001 California Statewide Travel Survey, 2001 NHTS Summary of Travel Trends
2. SACMET model, Fehr & Peers, 2010.
3. SANDAG Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region (April 2002)
4. NHTS Transferability, 2001 NHTS, http://nhts-gis.ornl.gov/transferability/Default.aspx

Appendix C.3

Induced Travel Memo

FEHR & PEERS
TRANSPORTATION CONSULTANTS

MEMORANDUM

Date: February 3, 2010

To: CAPCOA Team

From: Tien-Tien Chan, Jerry Walters, and Meghan Mitman

Subject: Induced Travel Material

SF10-0475

Induced travel is a term used to describe how travel demand responds to roadway capacity expansion and roadway improvements. Consistent with the theory of supply and demand, the general topic of research concerning induced travel is that reducing the cost of travel (i.e., reduced travel time due to a new road improvement) will increase the amount of travel. In other words, road improvements alone can prompt traffic increases. To what degree and under what circumstances these increases occur is a matter of debate and the key subject of most induced travel research. We have attached the following documents which represent research on induced travel effects:

- *Comparative Evaluations on the Elasticity of Travel Demand* – study conducted for the Utah DOT which included national literature review of induced travel studies
- *Are Induced-Travel Studies Inducing Bad Investments?* – article by Cervero in Access Magazine: Transportation Research at the University of California
- *Road Expansion, Urban Growth, Growth, and Induced Travel: A Path Analysis* – APA Journal paper by Cervero, also discusses the impacts of induced growth and induced investments

The reader should be aware that conditions may vary considerably and the extent of induced travel depends on a variety of factors, including: the degree of prior congestion in the corridor, its duration over hours of the day, its extent over lane miles of the corridor, the degree to which un-served traffic diverts to local streets and the degree of congestion on those routes, the availability of alternate modes within the corridor, whether corridor is radial and oriented toward downtown with high parking cost and limited availability or circumferential, planned level of growth in the corridor, whether the corridor is interstate or interregional, whether it is a truck route, and other factors.

GHG reduction strategies such as transportation system management (e.g. signal coordination, adaptive signal control) may also have the potential for inducing travel. For such strategies, if the estimated improvement exceeds 10% benefit in travel time reduction, we recommend conducting project specific analysis on induced travel prior to establishing GHG reduction benefits.

Appendix D

Building Mitigation Measure Quantification Methods

This Appendix summarizes the steps and assumptions used in two of the mitigation strategies – exceed Title 24 energy efficiency standards (BE-1) and installing energy efficient appliances (BE-4).

Background

GHGs are emitted as a result of activities in residential and commercial buildings when electricity and natural gas are used as energy sources. New California buildings must be designed to meet the building energy efficiency standards of Title 24, also known as the California Building Standards Code. Title 24 Part 6 regulates energy uses including space heating and cooling, hot water heating, ventilation, and hard-wired lighting. By committing to a percent improvement over Title 24, a development reduces its energy use and resulting GHG emissions.

The Title 24 standards have been updated twice (in 2005 and 2008)[1] since some of these data used to estimate energy use were compiled. California Energy Commission (CEC) has published reports estimating the percentage deductions in energy use resulting from these new standards. Based on CEC's discussion on average savings for Title 24 improvements, these CEC savings percentages by end use can be used to account for reductions in electricity and natural gas use due to the two most recent updates to Title 24. Since energy use for each different system type (ie, heating, cooling, water heating, and ventilation) as well as appliances is defined in this survey, the use of survey data with updates for Title 24 will easily allow for application of mitigation measures aimed at reducing the energy use of these devices in a prescriptive manner.

Another mitigation measure to reduce a building's energy consumption as well as the associated GHG emissions from natural gas combustion and electricity production is to use energy-efficient appliances. For residential dwellings, typical builder-supplied appliances include refrigerators and dishwashers. Clothes washers and ceiling fans would be applicable if the builder supplied them. For commercial land uses, only energy-efficient refrigerators have been evaluated for grocery stores.

1 California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
California Energy Commission. 2006. California Commercial End-Use Survey. Prepared by Itron Inc. Available at: http://www.energy.ca.gov/ceus/

Methodology

Datasets

The Residential Appliance Saturation Survey (RASS)[2] and California Commercial Energy Use Survey (CEUS)[3] datasets were used to estimate the energy intensities of residential and non-residential buildings, respectively, since the data is available for several land use categories in different climate zones in California. The RASS dataset further differentiates the energy use intensities between single-family, multi-family and townhome residences.

The Energy Star and Other Climate Protection Partnerships 2008 Annual Report[4] and subsequent Annual Reports were reviewed for typical reductions for energy-efficient appliances. ENERGY STAR residential refrigerators, clothes washers, dishwashers, and ceiling fans use 15%, 25%, 40%, and 50% less electricity than standard appliances, respectively. ENERGY STAR commercial refrigerators use 35% less electricity than standard appliances.

Calculations

Exceeding Title 24 Energy Efficiency Standards (BE-1)

RASS and CEUS datasets were used to obtain the energy intensities of different end use categories for different building types in different climate zones. Energy intensities from CEUS are given per square foot per year and used as presented. RASS presents Unit Energy Consumption (UEC) per dwelling unit per year and saturation values; the energy intensities used in this analysis are products of the UEC and saturation values.

Data for some climate zones is not presented in the CEUS and RASS studies. However, data from adjacent climate zones is assumed to be representative and substituted as follows:

For non-residential building types:
Climate Zone 11 used Climate Zone 9 data.
Climate Zone 12 used Climate Zone 9 data.
Climate Zone 14 used Climate Zone 1 data.
Climate Zone 15 used Climate Zone 10 data.

For residential building types:
Climate Zone 6 used Climate Zone 2 data.
Climate Zone 14 used Climate Zone 1 data.
Climate Zone 15 used Climate Zone 10 data.

RASS and CEUS data are based on 2002 consumption data. Because older buildings tend to be less energy efficient, and the majority of the buildings in the survey were likely constructed

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2 California Statewide Residential Appliance Saturation Study Reporting Center. Available at: http://websafe.kemainc.com/RASSWEB/DesktopDefault.aspx
3 California Energy Commission. 2006. California Commercial End-Use Survey. Prepared by Itron Inc. Available at: http://www.energy.ca.gov/ceus/
4 United States Environmental Protection Agency 2009. ENERGY STAR and Other Climate Protection Partnerships: 2008 Annual Report. Available at: http://www.epa.gov/cpd/pdf/2008AnnualReportFinal.pdf

before 2001, the RASS and CEUS data likely overestimate energy use for a 2001 Title 24-compliant building.

To account for updates since the 2001 Title 24 standards, percentage reductions for each end use category taken directly from the CEC's "Impact Analysis for 2005 Energy Efficiency Standards" and "Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings" reports were applied to the CEUS and RASS datasets for improvements from 2001 to 2005, and 2005 to 2008, respectively (see Tables D-1 and D-2). For the CEUS data, exterior lighting was assumed to be covered by Title 24 lighting and therefore has the full percentage reductions taken. Interior lighting was assumed to be 50% Title 24 and 50% non-Title 24 uses. Therefore only half of the reduction for lighting was applied. The resulting 2008 numbers were then used as baseline energy intensities for this mitigation strategy. The total baseline energy intensities are calculated as follows:

$$\text{Baseline} = \sum\left[T24_{2001}\times\left(1-R_{2001\text{-}2005}\right)\times\left(1-R_{2005\text{-}2008}\right)\right]+\sum NT24$$

Where:

Baseline = Total baseline energy intensities of building category
$T24_{2001}$ = Energy intensities of Title 24 regulated end use from RASS or CEUS
$R_{2001\text{-}2005}$ = Reduction from 2001 to 2005
$R_{2005\text{-}2008}$ = Reduction from 2005 to 2008
NT24 = Non-Title 24 regulated end use energy intensities

Table D-1
Reduction in Title 24 Regulated End Use for Non-Residential Buildings

Energy Source	End Use	Reduction from 2001 to 2005	Reduction from 2005 to 2008
Electricity	Heating	4.9%	37.2%
	Ventilation	5.0%	1.5%
	Refrigeration	0.0%	0.0%
	Process	0.0%	0.0%
	Office Equipment	0.0%	0.0%
	Motors	0.0%	0.0%
	Miscellaneous	0.0%	0.0%
	Interior Lighting	4.9%	5.9%
	Water Heating	0.0%	0.0%
	Cooking	0.0%	0.0%
	Air Compressors	0.0%	0.0%
	Cooling	6.7%	8.3%
	Exterior Lighting	9.8%	11.7%
Natural Gas	Cooking	0.0%	0.0%
	Cooling	10.4%	9.3%
	Heating	3.1%	15.9%
	Water Heating	0.0%	0.0%
	Process	0.0%	0.0%
	Miscellaneous	0.0%	0.0%

Table D-2
Reduction in Title 24 Regulated End Use for Residential Buildings

Energy Source	End Use (As presented in RASS Dataset)	Reduction from 2001 to 2005			Reduction from 2005 to 2008		
		Multi-family	Single family	Town home	Multi-family	Single family	Town home
Electricity	Conv. Electric heat	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	HP Eheat	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	Aux Eheat	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	Furnace Fan	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	Central A/C	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	Room A/C	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	Evap Cooling	24.3%	19.8%	24.3%	19.7%	22.7%	19.7%
	Water Heat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Solar Water Heater	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Dryer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Clothes Washer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Dish Washer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	First Refrigerator	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Second Refrigerator	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Freezer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pool Pump	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Spa	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Outdoor Lighting	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Range/Oven	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	TV	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Spa Electric Heat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Microwave	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Home Office	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	PC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Water Bed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Well Pump	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Miscellaneous	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Natural Gas	Primary Heat	15.7%	6.7%	15.7%	7.0%	10.0%	7.0%
	Auxiliary Heat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Conv. Gas Water Heat	15.7%	6.7%	15.7%	7.0%	10.0%	7.0%
	Solar Water Heat w/Gas Backup	15.7%	6.7%	15.7%	7.0%	10.0%	7.0%
	Dryer	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Range/Oven	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pool Heat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Spa Heat	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Miscellaneous	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

The same approach was used to quantify GHGs emission reduction from exceeding Title 24 energy efficiency standards by 1%. The 1% reduction was applied to only energy use intensities for Title 24 regulated end use categories. For the CEUS data, the reduction was not applied to any portion of interior lighting. The reduced energy use intensities were added to the unadjusted energy use intensities for non-Title 24 regulated end use categories to obtain the total energy use intensities for exceeding Title 24 energy efficiency standards by 1% for each building category. These were then compared to the baseline line energy intensities for the overall percentage reduction as follows:

$$\text{Percentage Reduction} = 1 - \frac{\sum\left[T24_{2001} \times \left(1 - R_{2001\text{-}2005}\right) \times \left(1 - R_{2005\text{-}2008}\right) \times 99\%\right] + \sum NT24}{\text{Baseline}}$$

Where:

Baseline	=	Total baseline energy intensities of building category
$T24_{2001}$	=	Energy intensities of Title 24 regulated end use from RASS or CEUS
$R_{2001\text{-}2005}$	=	Reduction from 2001 to 2005
$R_{2005\text{-}2008}$	=	Reduction from 2005 to 2008
NT24	=	Non-Title 24 regulated end use energy intensities

Installing Energy Efficient Appliances

The same baseline line energy use intensities from the Exceeding Title 24 Energy Efficiency Standards mitigation were used for this mitigation strategy. For all appliances except ceiling fan, the reductions as presented in the ENERGY STAR 2008 annual report were applied to the energy use intensities of the corresponding energy end use categories. All other end use categories were kept unadjusted. The percentage reductions were calculated as follows:

$$\text{Percentage Reduction} = 1 - \frac{\text{Appliance Intensity} \times \left(1 - \text{ESR}\right) + \sum \text{Other End Use}}{\text{Baseline}}$$

Where:

Baseline	=	Total baseline energy intensities of building category
Appliance Intensity	=	2008 baseline energy intensity of appliance in consideration
ESR	=	Reduction from ENERGY STAR appliance
Other End Use	=	2008 baseline energy intensity of all other end uses

RASS does not specify a ceiling fan end-use; rather, electricity use from ceiling fans is accounted for in the “Miscellaneous” category which includes interior lighting, attic fans, and other miscellaneous plug-in loads. Since the electricity usage of ceiling fans alone is not specified, a value from the National Renewable Energy Laboratory (NREL) Building American Research Benchmark Definition (BARBD)[5] was used. BARBD reported that the average energy use per ceiling fan is 84.1 kWh per year. In this mitigation measure, it was assumed that each multi-family, single-family, and townhome residence has one ceiling fan. Therefore, the 50% reduction from ENERGY STAR for ceiling fan was applied to 84.1 kWh of the electricity attributed to the Miscellaneous RASS category. In other words, 42.05 kWh was subtracted from the electricity end use intensities of the "Miscellaneous RASS" category in evaluating the GHGs emission reduction from installing energy efficient ceiling fans.

The total energy use intensities with reduction from each appliance in consideration were then compared to the baseline line energy intensities for the overall percentage reduction as follows:

$$\text{Percentage Reduction} = 1 - \frac{(\text{Misc} - 42.05) + \sum \text{Other End Use}}{\text{Baseline}}$$

Where:

Baseline = Total baseline energy intensities of building category

Misc = 2008 energy intensity in Miscellaneous category for electricity

Other End Use = 2008 baseline energy intensity of all other end uses

5 NREL. 2010. Building America Research Benchmark Definition. Available online at: http://www.nrel.gov/docs/fy10osti/47246.pdf

Appendix E

Carbon, Water and CO_2 Sequestration Intensity Factors

Table E-1: Carbon Intensity

Utility	CO_2 intensity (lb/MWh)[1]								
	2000	2001	2002	2003	2004	2005	2006	2007	Suggested Value[2]
Anaheim Public Utilities						1,399.80	1,416.74	1,543.28	1,416.74
Austin Energy						1,127.37	1,077.97	1,117.37	1,077.97
City and County of San Francisco						76.28			76.28
City of Palo Alto Public Utilities						320.94	39.02	426.82	39.02
Glendale Water & Power						1,065.00			1,065.00
Los Angeles Department of Water & Power	1,407.44	1,403.39	1,348.48	1,360.07	1,360.60	1,303.58	1,238.52	1,227.89	1,238.52
Pacific Gas & Electric Company					566.2	489.16	455.81	635.67	455.81
PacifiCorp					1,811.00	1,812.22	1,747.30	1,775.28	1,747.30
Pasadena Water & Power						1,409.65	1664.14		1,664.14
Platte River Power Authority						1,970.93	1,955.66	1,847.88	1,955.66
Riverside Public Utilities						1,333.45	1,346.15	1,325.65	1,346.15
Roseville Electric							565.52	793.8	565.52
Sacramento Municipal Utility District					769	616.07	555.26	714.31	555.26
Salt River Project							1,546.28	1,469.90	1,546.28
San Diego Gas & Electric					613.75	546.46	780.79	806.27	780.79
Seattle City Light								17.77	17.77
Sierra Pacific Resources								1,442.78	1,442.78
Southern California Edison					678.88	665.72	641.26	630.89	641.26
Turlock Irrigation District							682.48	807	682.48

Notes:
1. Based on Table G6 of Local Government Operation Protocol version 1.1
2. The suggested values are based on 2006. If no 2006 value was available, 2005 was used followed by 2007.

Table E-2: Water Intensity

	Indoor Water Uses		Outdoor Water Uses	
	Northern California	Southern California	Northern California	Southern California
	kWh/MG			
Water Supply and Conveyance	2,117	9,727	2,117	9,727
Water Treatment	111	111	111	111
Water Distribution	1,272	1,272	1,272	1,272
Wastewater Treatment	1,911	1,911	0	0
Regional Total	5,411	13,022	3,500	11,111

Note: Based on Table ES-1 from CEC. 2006. Refining Estimates of Water-Related Energy Use in California, CEC-500-2006-118.

Table E-3: Default CO_2 Sequestration Accumulation

Land Use	Sub-Category	Default annual CO_2 accumulation per acre[1] (tonnes CO_2/year)
Forest Land	Scrub	14.3
	Trees	
Cropland		111
Grassland	--	6.2
Wetlands	--	4.31

Note: Based on Tables 4.3, 4.7 and 6.4 from IPCC. 2006. Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines). Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

EXHIBIT B

Share:

Greenhouse Gases

On March 18, 2010, amendments to the CEQA Guidelines (California Code of Regulations, Title 14) became effective that incorporated requirements to analyze greenhouse gas (GHG) emission impacts and, if significant, identify feasible measures to mitigate significant adverse GHG impacts. In response to these changes, the California Air Pollution Control Officers Association (CAPCOA) developed a comprehensive guidance document for quantifying the effectiveness of GHG mitigation measures. CAPCOA's report, Quantifying Greenhouse Gas Mitigation Measures, was developed with the support and cooperation of the South Coast Air Quality Management District.

CAPCOA's report specifically addresses appropriate procedures for applying quantification methods to achieve accurate and reliable results. The Report includes background information on programs and concepts associated with the quantification of GHG emissions. The Report does not provide policy guidance on any of these issues, nor does it dictate how any jurisdiction should address questions of policy. Policy considerations are left to individual agencies and their governing boards. Rather, this Report is intended to support the creation of a standardized approach to quantifying mitigation measures, to allow emission reductions and measure effectiveness to be considered and compared on a common basis. CAPCOA's report can be accessed at the link below

Quantifying Greenhouse Gas Mitigation Measures (/docs/default-source/ceqa/handbook/mitigation-measures-and-control-efficiencies/quantifying-greenhouse-gas-mitigation-measures.pdf?sfvrsn=0)

YOU MAY ALSO LIKE ...

Related Topics

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EXHIBIT C

Regulations for Emissions from Heavy Equipment with Compression-Ignition (Diesel) Engines

Related Topics

- Controlling air pollution from stationary engines
- Emission Standards Reference Guide
- Frequently Asked Questions from Owners and Operators of Nonroad Engines, Vehicles, and Equipment Certified to EPA Standards (PDF) (4 pp, 475 K, February 2018, EPA-420-F-18-004, About PDF)
- How to Maintain or Rebuild Engines Certified to EPA Standards (PDF) (4 pp, 466 K, February 2018, EPA-420-F-18-003, About PDF)
- Regulations for emissions from heavy equipment with spark-ignition engines

On this page:

Overview

This page provides regulations for nonroad compression-ignition (diesel) engines that are used in machines that perform a wide range of important jobs. These include excavators and other construction equipment, farm tractors and other agricultural equipment, forklifts, airport ground service equipment, and utility equipment such as generators, pumps, and compressors.

EPA has adopted multiple tiers of emission standards. Most recently, we adopted a comprehensive national program to reduce emissions from nonroad diesel engines by integrating engine and fuel controls as a system to gain the greatest emission reductions. To meet these Tier 4 emission standards, engine manufacturers will produce new engines with advanced emission control technologies. Because the emission control devices can be damaged by sulfur, we have also adopted requirements for in-use diesel fuel to decrease sulfur levels by more than 99 percent. The resulting Ultra Low Sulfur Diesel Fuel has a maximum sulfur concentration of 15 parts per million.

Basic Research

Data for reproducing real-world activity of various nonroad compression ignition (CI, diesel) engines in a controlled setting is available on this page:
EPA Nonregulatory Nonroad Duty Cycles

List of Related e-CFR Links

See the Electronic Code of Federal Regulations (e-CFR) for the full text of current regulations that apply to large CI engines.

e-CFR link	Summary of what you will find
40 CFR Part 1039	Tier 4 emission standards and certification requirements
40 CFR Part 1065	Exhaust emission test procedures (for lab and in-field testing)
40 CFR Part 1068	General compliance provisions

List of Related Regulations

Below is a list of all regulations related to emissions from heavy equipment with compression-ignition (diesel) engines.

Help

For help on using the table:

- View Table Instructions

Click the regulation titles for additional information, including:

- Rule summaries;
- Regulatory impact analyses;
- Comment summaries;
- Rule histories (including proposed rules); and
- Fact sheets.*

*Note: Rule-related materials vary by rule.

Show All ▼ entries Search:

Regulation Title	**Referenced Tier Level(s)** ***(if applicable)***	**Regulation Date** ***(Year/Month)***
Final Rule for Emergency Vehicle Rule—SCR Maintenance and Regulatory Flexibility for Nonroad Equipment		2014/08
Final Rule for Nonroad Technical Amendments		2014/02
Direct Final Rule for Heavy-Duty Engine and Vehicle, and Nonroad Technical Amendments		2013/06
Direct Final Rule for Heavy-Duty Highway Program: Revisions for Emergency Vehicles		2012/06
Final Rule for Control of Emissions From New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder		2010/04
Greenhouse Gas Reporting Program (GHGRP)		2009/10

Regulation Title	**Referenced Tier Level(s)** ***(if applicable)***	**Regulation Date** ***(Year/Month)***
Final Rule for Control of Emissions From Nonroad Spark-Ignition Engines and Equipment		2008/10
Final Rule for Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder		2008/06
Partial Withdrawal and Final Rule for the Nonroad Diesel Technical Amendments and Tier 3 Technical Relief Provision		2007/12
Direct Final Rule: Nonroad Diesel Technical Amendments and Tier 3 Technical Relief Provision	Tier 3	2007/09
Direct Final Rule for Control of Air Pollution From New Motor Vehicles; Revisions to Motor Vehicle Diesel Fuel Sulfur Transition Provisions; and Technical Amendments to the Highway Diesel, Nonroad Diesel, and Tier 2 Gasoline Programs		2005/11
Final Rule for Test Procedures for Testing Highway and Nonroad Engines and Omnibus Technical Amendments		2005/07
Final Rule for Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel	Tier 4	2004/06
Final Rule for Control of Emissions From New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder	Tier 1	2003/02
Final Rule for Control of Emissions of Air Pollution From Nonroad Diesel Engines	Tier 2, Tier 3	1998/10

Regulation Title	**Referenced Tier Level(s)** ***(if applicable)***	**Regulation Date** ***(Year/Month)***
Direct Final Rule: Amendments to Emission Requirements Applicable to New Nonroad CI Engines at or Above 37 Kilowatts: Provisions for Replacement CI Engines and the Use of On-Highway CI Engines in Nonroad Vehicles		1996/11
Final Rule for Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engine At or Above 37 Kilowatts	Tier 1	1994/06

Showing 1 to 17 of 17 entries

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LAST UPDATED ON MAY 10, 2018

EXHIBIT D

Verification Procedure - Currently Verified

This page last reviewed June 12, 2019

The following information is provided as a summary of verified diesel emission control strategies. Additional requirements specific to engine compatibility are provided in the Executive Order. The factors outlined in the Executive Order are legal requirements of each verification; therefore, these conditions must be met before determining if a particular device is applicable to the end-users type of engine. The Air Resources Board recommends that you contact the manufacturer, or their authorized distributor, prior to making any purchasing decision. Please click on the manufacturer link for additional information.

Cleaire products have not been available for sale or lease since it ceased operations on January 18, 2013. ESW CleanTech Incorporated (ESW CleanTech) acquired the Cleaire product line on April 18, 2013, and will provide new sales of product under its ownership as well as support for existing Cleaire customers. Vehicles that have the Cleaire devices already installed in a verified configuration will continue to meet applicable in-use fleet rule requirements. Please refer to the following website for additional information: Cleaire Information Page

PM Level	Product Name	Technology Type	PM Reduction	NOx Reduction	Applicability
LEVEL 3	Baumot	DOC+DPF	85%	N/A	Baumot AG, Diesel Particulate Filter System BAB-US for 375 to 500 horsepower, on-road vehicles not equipped with exhaust gas recirculation
	Carrier ClearSky DPF (formerly IMPCO)	DOC+DPF	85%	N/A	Carrier and ComfortPro auxiliary power units powered by select Kubota Z482 diesel engines with model years between 2009 and 2017.
	Carrier EES	DOC+DPF	85%	N/A	Carrier Transicold X4-Series and Vector 8500 /8600MT TRUs and UG/RG TRU gensets with Tier 4f engines rated at <25 hp
	Carrier Legacy EES	DOC+DPF	85%	N/A	Carrier Transicold TRU models X2-Series, XT-Series, XTC-series, Genesis TM900, Genesis TM1000, Ultra XL (with and without standby), Vector 6500, and 6600MT equipped

				with model years 2004 through 2012 Kubota engines.
Catalytic Exhaust Products Ltd. Dieselytic SXS-SC DPF	DPF	85%	N/A	Stationary prime and emergency standby generators and pumps with Tier 1, Tier 2, or Tier 3 certified off-road engines meeting 0.2 g/bhp-hr or less diesel PM
CDTi Purifilter EGR	DPF	85%	N/A	2002-2010 model year; on-road; CARB diesel; biodiesel.*
CDTi Purifilter H (High Load)	DPF	85%	N/A	1993-2006 CA certified engines; Specific 1994-2006 Federally certified engines; on-road; CARB diesel; biodiesel.*
CDTi Purifilter Plus	DPF	85%	N/A	1993 and 2010 on-road; CARB diesel; biodiesel.*
CDTi Purifilter Plus M	DPF	85%	N/A	1993 - 2010 on-road; CARB diesel; biodiesel.*
Clariant Corporation EnviCat�- DPF	DPF	85%	N/A	Stationary prime and emergency standby generators and pumps; CARB diesel; biodiesel.*
Cummins Pacific eMission DPF	DPF	85%		Stationary emergency standby generators with a PM emission rate of 0.15 g/bhp-hr or less and between 23 to 78 liter displacements.
DCL International Inc.	DPF	85%	N/A	1996-2011 model year, off-road; CARB diesel; biodiesel.*
DCL International Inc. TITAN (formerly Roadwarrior)	DPF	85%	N/A	1994-2004 model year, on-road; CARB diesel; biodiesel.*
DCL International Inc.	DPF	85%	N/A	Stationary prime and emergency standby generators, pumps, and compressors; Tier 1, 2, or 3 off-road engines certified to < 0.15 g/bhp-hr PM; CARB diesel; biodiesel.*
Diesel Emission Technologies UltraTrap	DPF	85%	N/A	1994-2006 on-road;CARB diesel; biodiesel.*
Donaldson LNF	DPF	85%	N/A	1993-2006 model year on-road; CARB diesel; biodiesel. CARB diesel; biodiesel.*
Donaldson LXF	DPF	85%	N/A	2002-2006 model year on-road; CARB diesel; biodiesel.*
Donaldson SEF	DPF	85%	N/A	1991-2006 model year on-road; CARB diesel; biodiesel.*
Engine Control	DPF	85%	N/A	1994-2004 on-road;CARB diesel;

System Purifilter L (Low Load)				biodiesel.*
Engine Control System Combifilter	DPF	85%	N/A	2007 or older off-road; CARB diesel; biodiesel.*
ESW CleanTech Horizon	DPF	85%	N/A	Most four-stroke on-road engines through 2006; CARB diesel; biodiesel.*
ESW CleanTech LongMile-S	DPF	85%	N/A	1993 - 2010 model year on-road applications; CARB diesel; biodiesel.*
ESW CleanTech Longview	Lean NOx Catalyst and DPF	85%	25%	1993-2006 model year on-road; CARB diesel; biodiesel.*
ESW CleanTech Phoenix	DPF	85%	N/A	Most 1996 - 2014 off-road; CARB diesel; biodiesel.*
ESW CleanTech Skyline	DPF	85%	N/A	Most off-road; CARB diesel; biodiesel.*
ESW CleanTech Vista	DPF	85%	N/A	1993-2010 model year on-road; CARB diesel; biodiesel.*
ESW Technologies ThermaCat	DPF	85%	N/A	1996-2010; off-road; 1993-2006 on-road; CARB diesel; biodiesel.*
ESW Technologies ThermaCat™ e	DPF	85%	N/A	1994-2009; on-road; with EGR; CARB diesel; biodiesel.*
Global Emissions Systems, Inc. (GESi) 6000DPF	DPF	85%	N/A	Stationary prime and emergency standby generators and pumps with Tier 1, Tier 2, or Tier 3 certified off-road engines meeting 0.2 g/bhp-hr or less diesel PM
GT Exhaust's GTE Purity DPF	DPF	85%	N/A	Stationary prime and emergency standby generators and pumps with Tier 1, Tier 2, Tier 3, Tier 4i with a rated horse power between 50 and 75 or over 750, or Tier 4 Alt 20% NOx and PM nonroad or stationary engines meeting 0.2 g/bhp-hr or less diesel PM
HUG Engineering, Inc Mobiclean R	DPF	85%	N/A	Most 1991 - 2006 on-road; CARB diesel; biodiesel. *
HUG Engineering USA combiKat	DPF	85%	N/A	Stationary emergency and prime generators with a PM emission rate of 0.2 g/bhp-hr or less.

HUSS FS-MK Off-Road	DPF	85%	N/A	Most off-road through 2011 MY; CARB diesel; biodiesel. *
HUSS FS-MK On-Road	DPF	85%	N/A	Most on-road diesel engines through 2006 MY and most off-road through 2010 MY; CARB diesel; biodiesel. *
HUSS MK 35 and MK 50 for TRU	DPF	85%	N/A	Verified for 1998 and newer TRU's. CARB diesel; biodiesel. *
Johnson Matthey AdvCCRT	DPF	85%	N/A	Specifc 2002-2006; on-road; CARB diesel; biodiesel.*
Johnson Matthey CRTreformulated	DPF	85%	N/A	1993 - 2006; on-road; CARB diesel; biodiesel.*
Johnson Matthey CRT	DPF	85%	N/A.	Stationary emergency/standby generators; conditionally verified for stationary prime generators. CARB diesel; biodiesel.*
Johnson Matthey EGRT	EGR/DPF	85%	40%	2000 International DT-466, 2000 Cummins ISM 2001 Cummins ISB, 1998-2002 Cummins ISC, 2001 Cummins ISL, 2001 MY DDC - 50, and 2001 DDC - 60. on-road; CARB diesel.
MIRATECH Corporation combiKat	DPF	85%	N/A	Stationary emergency and prime generators with a PM emission rate of 0.2 g/bhp-hr or less.
MIRATECH� LTR™ DOC/DPF System	DPF	85%	N/A	Stationary emergency standby generators with a PM emission rate of 0.22 g/bhp-hr or less.
Nett Technologies. NETT GreenTRAP™ DPF	DPF	85%	N/A	Stationary prime and emergency standby generators and pumps with Tier 1, Tier 2, or Tier 3 certified off-road engines meeting 0.2 g/bhp-hr or less diesel PM
Nett BlueMAX™ NOVA 300e System	DPF SCR	85%	85%	Stationary prime generators with a PM emission rate of 0.2 g/bhp-hr or less.
New World Engineering, LLC EADPF	DPF	85%	N/A	Thermo King single temp TRUs, 2005 to present Yanmar diesel engines <25 hp
Proventia EHDPF	DPF	85%	N/A	Thermo King Tripac APU, powered by select model year 2007 to 2016 Yanmar TK270M or TK270VFM diesel engines with a diesel particulate matter certification of 0.2 grams per kilowatt hour or less.

	RYPOS, Inc. ActiveDPF/C3+™	DPF	85%	N/A	Verified for both diesel-electric and diesel-hydraulic rubber tired gantry (RTG) cranes; CARB diesel; biodiesel.*
	RYPOS DPF/ULETRU	DPF	85%	N/A	2003 and newer Carrier and ThermoKing TRU's and Pin-on TRU Gensets.
	RYPOS DPF/ULETRU	DPF	85%	N/A	2003 and newer Thermo King Multi-Temp TRU's.
	Rypos, Inc. HDPF/C™	Hybrid DPF	85%	N/A	1996-2007 stationary emergency standby generators and pumps with a PM emission rate of 0.2 g/bhp-hr or less and certified to Tier 1, Tier 2, or Tier 3 off-road diesel engine standards; CARB diesel; biodiesel.*
	Safety Power Inc., FOx� System	DPF	85%	N/A	Stationary prime and emergency standby generators and pumps; CARB diesel; biodiesel.*
	Thermo King eDPF	DPF	85%	N/A	2006-2016 Thermo King auxilary power units; CARB diesel.
	Universal Emissions Technologies GreenShield� DPF	DPF	85%	N/A	Stationary prime and emergency standby power generators and pumps with Tier 1, Tier 2, or Tier 3 certified off-road engines.
LEVEL 2	Engine Control System AZ Purimuffler/Purifier	DOC + Alt Fuel	50%	20%	1996-2002 off-road; PuriNOx
	Lubrizol PuriNOx	Emulsified Fuel	50%	15%	1988-2003 on-road.
	Proventia FTF ™	FTF	50%	N/A	Most Thermo King trailer TRUs using 1985 through 2003 model year engines; CARB diesel; biodiesel.*
	Proventia Bobtail FTF ™	FTF	50%	N/A	Select Thermo King truck TRUs using 1987 to 2004 model year engines or Carrier Transicold truck TRUs using 1994 to 2004 model year engines. CARB diesel; biodiesel*
	Rypos ADPF	DPF	50%	N/A	1996-2008 stationary engines (certified to Tier 1, 2, or 3 off-road PM emission level); CARB diesel; biodiesel*; no EGR, DOC or pre-existing DPF.
	Rypos, Inc. DPF/LETRU™	DPF	50%	N/A	Applicability: Most trailer TRUs using 2003 and older model year engines; ULSD CARB diesel (less than 15 ppm sulfur).

	Rypos, Inc. ADPF	DPF	50%	N/A	Marine Harbor Craft
	Rypos ActiveDPF/C™	DPF	50%	N/A	Both diesel-electric and diesel-hydraulic rubber tired gantry (RTG) cranes; CARB diesel; biodiesel.*
LEVEL 1	Viscon California, LLC	Fuel Additive	25%	N/A	1985-1995 off-road; CARB diesel.
	Vycon REGEN System	Energy Storage System	25%	30%	Pre-1996 model year or Tier 1, 2, or 3 certified off-road diesel engines on rubber-tired gantry cranes; biodiesel. *

* These systems have been verified for use with biodiesel blends subject to certain requirements.

EXHIBIT E

ISSUED February 2018

09 91 23 - INTERIOR

California Department of Public Health (CDPH) Method v1.1-2010 & V1.2-2017 Specification (CA section 01350)

THE SHERWIN-WILLIAMS COMPANY

COMMERCIAL PAINTING SCHEDULE GUIDE

This Emissions criteria/CDPH V1.1-2010 & V1.2-2017 Painting Schedule is furnished only as a guide to select interior paint systems, and is not all-inclusive of available Sherwin-Williams products. Although it is written in the CSI format and can be included in its entirety in a master specification, one should review the contents and edit to suit the particular needs of the project and its respective location.

As of the date January 31, 2018 the products listed in this guide have been independently certified by UL Environment in accordance with “UL 2818 –GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings, ” and/or comply with California Department of Public Health “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1” (CA Section 01350) & V1.2-2017. For more information, see https://spot.ulprospector.com. Building products and Interior finishes are determined compliant in accordance with California Department of Public Health (CDPH) Standard Method V1.1-2010 &V1.2-2017using the applicable exposure scenario(s).

Local and National V.O.C. (Volatile Organic Compound) regulations have been taken into consideration, but because these regulations vary greatly around the country and are subject to change, we suggest verifying that product selections meet the requirements of the area in which they are to be used. If the project is located within the OTC, CARB, SCAQMD or other VOC regulated regions, one must comply with the regulations regarding VOCs. It is always recommended that you consult with a LEED® AP or a Sherwin-Williams Company Representative before finalizing the selection.

If you need more specific information on a particular product, refer to the current Sherwin-Williams Painting Systems Catalog, sherwin-williams.com websites or call our Architectural Services Department toll free.
UL/GREENGUARD Certified products are certified to UL/GREENGUARD standards for low chemical emissions into indoor air during product usage. For more information, visit ul.com. Certificates can be found on: https://spot.ulprospector.com

The Sherwin-Williams Company
Architectural Services Department
1-800-321-8194 (Telephone)
216-566-1660 (Fax)

SECTION 09 91 23

INTERIOR PAINTS AND COATINGS

Part 1 GENERAL

1.1 SECTION INCLUDES

A Interior paint and coatings systems

1.2 RELATED SECTIONS

A Section 05 05 13 - Shop Applied Coatings for Metal

B Section 06 01 40 - Architectural Woodwork Refinishing

C Section 06 05 83 - Shop Applied Wood Coatings

D Section 07 19 00 - Water Repellents

E Section 09 67 00 - Fluid Applied Flooring for Concrete

F Section 09 93 00 - Stains and Transparent Finishes

G Section 09 96 00 - High-Performance Coatings

1.3 REFERENCES

A SSPC-SP 1 - Solvent Cleaning

B SSPC-SP 2 - Hand Tool Cleaning

C SSPC-SP 3 - Power Tool Cleaning

D SSPC-SP 13 / Nace No. 6 Surface Preparation for Concrete

F UL 2818 –GREENGUARD Certification Program for Chemical Emissions for Building Materials

G California Department of Public Health- CDPH v1.1-2010 & V1.2-2017

1.4 SUBMITTALS

A Submit under provisions of Section 01 33 00, Submittal Procedures.

B Product Data: Manufacturer's data sheets on each paint and coating product should include:

1 Product characteristics
2 Surface preparation instructions and recommendations
3 Primer requirements and finish specification
4 Storage and handling requirements and recommendations
5 Application methods
6 Clean-up Information
7. VOCs

C Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer’s color samples available.

D Coating Maintenance Manual: upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Paint Maintenance Manual” report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MOCK-UP

Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of painting on the project.

A Finish surfaces for verification of products, colors, & sheens
B Finish area designated by Architect
C Provide samples that designate prime & finish coats
D Do not proceed with remaining work until the Architect approves the mock-up samples

1.6 DELIVERY, STORAGE, AND HANDLING

A Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer’s name, label, and the following list of information:

Product name and type (description)
Application & use instructions
Surface preparation
VOC content
Environmental handling
Batch date
Color number

B Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
Store materials in an area that is within the acceptable temperature range, per manufacturer’s instructions. Protect from freezing.

C Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.7 PROJECT CONDITIONS

A Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits. This specification does not take into consideration wet areas or areas needing high performance coatings.

Part 2 PRODUCTS

2.1 MANUFACTURERS

A Acceptable Manufacturer:

The Sherwin-Williams Company
101 Prospect Avenue NW
Cleveland, OH 44115
Tel: (800) 321-8194
Fax: (216) 566-1660
sherwin-williams.com / swgreenspecs.com

B Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 Product Requirements.
When submitting request for substitution, provide complete product data specified above under Submittals, for each substitute product.

C Complies with California Department of Health Services' "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers" Version 1.1-2010 (CA section 01350) & V1.2-2017

2.2 APPLICATIONS/SCOPE

A Use this article to define the scope of painting if not fully defined in a Finish Schedule or on the drawings. This article must be carefully edited to reflect the surfaces actually found on the project. In some cases, it may be enough to use the first paragraph that says, in effect, "paint everything" along with a list of items not to paint, without exhaustively defining all the different surfaces and items that must be painted.

B If the project involves repainting some but not all existing painted surfaces, be sure to indicate the extent of the repainting.

C The descriptions of each system can also be used to further refine the definition of what is to be painted, stained, or clear finished.

D Surfaces to Be Coated:

Concrete - Poured, Precast, Tilt-Up, Cast-In-Place, Cement Board including Plaster
Masonry - (CMU - Concrete, Split Face, Scored, Smooth, etc.)
Metal – Aluminum/ Galvanized
Metal Ferrous-(Structural Steel, Joists, Trusses, Beams, Misc. & Ornamental Iron)
Wood - Walls, Ceilings, Doors, Trim
Drywall: Drywall board, Gypsum board

2.3 SCHEDULE INDEX

Index of Data pages

DATAPAGES AND EDS/SDS SHEETS: (To open any of the Data page Files, please click here)

UL/GREENGUARD Certifications may be found at www.greenguard.org / https://spot.ulprospector.com

Refer to the current EDS for specific VOCs. VOCs may vary by base and sheen.

****NOTES TO SPECIFIER****

- Specify the Harmony line, when a Formaldehyde Reducing* and/or Odor Eliminating* coating option is needed. Formaldehyde Reducing Technology helps improve indoor air quality by reducing VOCs from possible sources like insulation, carpet, cabinets and fabrics. Odor Eliminating Technology helps reduce common indoor odors so rooms stay fresher, longer. *The length of time Harmony actively reduces odors and formaldehyde depends on the concentration, the frequency of exposure and the amount of painted surface area.
- †Paint Shield® Microbicidal Paint is the first EPA-registered paint that kills greater than 99.9% *Staphylococcus aureus* (Staph), *Enterobacter aerogenes,* Methicillin-resistant *Staphylococcus aureus (MRSA)*, Vancomycin-resistant *Enterococcus faecalis* (VRE), and *Escherichia coli* (E.coli) within 2 hours of exposure on a painted surface.
- Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned with Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series
- For higher performance on ferrous and non-ferrous handrails and touch objects specify at minimum an epoxy finish for interior use.
- Primers may be optional if the Ceilings - Structural Steel, Joists, Trusses, Beams are already primed. Check for adhesion and compatibility prior to painting. Spot prime any bare areas with Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series
- Specify the Pro Industrial line when higher performance is needed.

EDIT THIS SCHEDULE TO SELECT PRODUCT AND FINISH DESIRED AND VOC NEEDS

2.3 SCHEDULE

A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place, Plaster) including (Walls, Ceilings)

1. Latex Systems

a. Gloss Finish

1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
(4 mils wet, 1.4 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
3rd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
(2-4 mils dry per coat)

b. Semi-Gloss Finish

1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar® 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
3rd Coat: S-W ProMar® 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.5 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Harmony® Interior Latex Semi-Gloss, B10 Series
3rd Coat: S-W Harmony® Interior Latex Semi-Gloss, B10 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
3rd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
(2-4 mils dry per coat)

A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place, Plaster) including (Walls, Ceilings) (Cont.)

1. Latex Systems

c. Eg-Shel Finish

1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series
3rd Coat: S-W ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
3rd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
3rd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
(2-4 mils dry per coat)

Microbicidal† Finish
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
3rd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
(4 mils wet, 1.8 mils dry per coat)

** NOTE TO SPECIFIER** †Paint Shield® Microbicidal Paint is the first EPA-registered paint that kills greater than 99.9% *Staphylococcus aureus* (Staph), *Enterobacter aerogenes,* Methicillin-resistant *Staphylococcus aureus (MRSA)*, Vancomycin-resistant *Enterococcus faecalis* (VRE), and *Escherichia coli* (E.coli) within 2 hours of exposure on a painted surface.

d. Low Sheen/Low Gloss Finish

1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss Eg-Shel, B41-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss Eg-Shel, B41-2600 Series
(4 mils wet, 1.6 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar 200 HP Zero VOC Latex Low Gloss Eg-Shel, B41-1900 Series
3rd Coat: S-W ProMar 200 HP Zero VOC Latex Low Gloss Eg-Shel, B41-1900 Series
(4 mils wet, 1.7 mils dry per coat)

A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up, Cast-In-Place, Plaster) including (Walls, Ceilings) (Cont.)

1. Latex Systems

e. Flat Finish

1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series
(4 mils wet, 1.4 mils dry per coat)

Alternate:
1st Coat: S-W Loxon Concrete and Masonry Primer
(200-300 sq ft/gal)
2nd Coat: S-W Harmony Interior Latex Flat, B5 Series
3rd Coat: S-W Harmony Interior Latex Flat, B5 Series
(4 mils wet, 1.7 mils dry per coat)

2. Epoxy System

a. Gloss Finish

1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
(2 - 5 mils dry per coat)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
(2 - 5 mils dry per coat)

3. Dryfall Waterborne Topcoat

a. Semi-Gloss Finish

1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss, B42-83
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss, B42-83
(6 mils wet, 2.3 mils dry)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Eg-Shel, B42-82
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Eg-Shel, B42-82
(6 mils wet, 2 mils dry)

c. Flat Finish

1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-81/181 Series
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-81/181 Series
(6 mils wet, 1.5 mils dry)

B. MASONRY - (CMU - Concrete, Split Face, Scored, Smooth, High /Low Density, Fluted) (non-wet area)

1. Latex Systems

a. Gloss Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
(4 mils wet, 1.4 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
3rd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
(2-4 mils dry per coat)

b. Semi-Gloss Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.5 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Harmony Interior Latex Semi-Gloss, B10 Series
3rd Coat: S-W Harmony Interior Latex Semi-Gloss, B10 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
3rd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
(2-4 mils dry per coat)

B. MASONRY - (CMU - Concrete, Split Face, Scored, Smooth, High /Low Density, Fluted) (non-wet area)

c. Eg-Shel Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series
3rd Coat: S-W ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
3rd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
3rd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
(2-4 mils dry per coat)

Microbicidal† Finish
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
3rd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
(4 mils wet, 1.8 mils dry per coat)

** NOTE TO SPECIFIER** †Paint Shield® Microbicidal Paint is the first EPA-registered paint that kills greater than 99.9% *Staphylococcus aureus* (Staph), *Enterobacter aerogenes,* Methicillin-resistant *Staphylococcus aureus (MRSA)*, Vancomycin-resistant *Enterococcus faecalis* (VRE), and *Escherichia coli* (E.coli) within 2 hours of exposure on a painted surface.

d. Low Sheen/Low Gloss Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss Eg-Shel, B41-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss Eg-Shel, B41-2600 Series
(4 mils wet, 1.6 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 HP Zero VOC Latex Low Gloss Eg-Shel, B41-1900 Series
3rd Coat: S-W ProMar 200 HP Zero VOC Latex Low Gloss Eg-Shel, B41-1900 Series
(4 mils wet, 1.7 mils dry per coat)

B. MASONRY - (CMU - Concrete, Split Face, Scored, Smooth, High /Low Density, Fluted) (non-wet area)

e. Flat Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series
(4 mils wet, 1.4 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Harmony Interior Latex Flat, B5 Series
3rd Coat: S-W Harmony Interior Latex Flat, B5 Series
(4 mils wet, 1.7 mils dry per coat)

2. Epoxy System (Water Base)

a. Gloss Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
(2 - 5 mils dry per coat)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
(2 - 5 mils dry per coat)

C. METAL - Aluminum/ Galvanized

1. Latex Systems

a. Gloss Finish

1st Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
2nd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
(2-4 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
(4 mils wet, 1.4 mils dry per coat)

b. Semi-Gloss Finish

1st Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
2nd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
(2-4 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Harmony Interior Latex Semi-Gloss, B10 Series
3rd Coat: S-W Harmony Interior Latex Semi-Gloss, B10 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.5 mils dry per coat)

c. Eg-Shel Finish

1st Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
2nd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
(2-4 mils dry per coat)

d. Flat Finish

1st Coat: S-W Pro Industrial™ DTM Acrylic Primer/Finish, B66-11
2nd Coat: S-W Pro Industrial™ DTM Acrylic Primer/Finish, B66-11
(5-10 mils wet, 1.9-3.9 mils dry)

Alternate:
1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Harmony Interior Latex Flat, B5 Series
3rd Coat: S-W Harmony Interior Latex Flat, B5 Series
(4 mils wet, 1.7 mils dry per coat)

C. METAL - Aluminum/ Galvanized (Cont.)

2. Epoxy System — Higher Performaning Finish (Including Handrails)

a. Gloss Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series (5-10 mils wet, 1.9-3.8 mils dry)

2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series

3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series (2 - 5 mils dry per coat)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series (5-10 mils wet, 1.9-3.8 mils dry)

2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series

3rd Coat: S-W Pro Industrial Water based Catalyzed Epoxy Eg-Shel, B73-360 Series (2 - 5 mils dry per coat)

3. Dryfall Waterborne Topcoat- (Galvanized; Ceilings, Duct work)

a. Semi-Gloss Finish

1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss, B42-83

2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss, B42-83 (6 mils wet, 2.3 mils dry)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Eg-Shel, B42-82

2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Eg-Shel, B42-82 (6 mils wet, 2 mils dry)

c. Flat Finish

1st Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-81/181 Series

2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-81/181 Series (6 mils wet, 1.5 mils dry)

D. METAL Ferrous- (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron)

1. Latex Systems

a. Gloss Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
3rd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
(2-4 mils dry per coat)

b. Semi-Gloss Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
3rd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
(2 - 4 mils dry per coat)

c. Eg-Shel Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
3rd Coat: S-W Pro Industrial™ Acrylic Eg-Shel, B66-660 Series
(2 - 4 mils dry per coat)

d. Flat Finish

1st Coat: S-W Pro Industrial™ DTM Acrylic Primer/Finish, B66-11
2nd Coat: S-W Pro Industrial™ DTM Acrylic Primer/Finish, B66-11
(5-10 mils wet, 1.9-3.9 mils dry)

D. METAL Ferrous- (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous & Ornamental Iron, Structural Iron) (Cont.)

2. Epoxy System— Higher Performaning Finish (Including Handrails)

a. Gloss Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
(2 - 5 mils dry per coat)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
(2 - 5 mils dry per coat)

3. Dryfall Waterborne Topcoats

a. Semi-Gloss Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss, B42-83
3rd Coat: Optional
(6 mils wet, 2.3 mils dry)

b. Eg-Shel Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Eg-Shel, B42-82
3rd Coat: Optional
(6.0 mils wet, 2 mils dry)

c. Flat Finish

1st Coat: S-W Pro Industrial™ Pro-Cryl® Universal Primer Off White, B66-1300 Series
(5-10 mils wet, 1.9-3.8 mils dry)
2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-81/181 Series
3rd Coat: Optional
(6.0 mils wet, 1.5 mils dry)

E. **WOOD - (Walls, Ceilings, Doors, Trim)**

1. **Latex Systems**

a. Gloss Finish

1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51 Series
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
3rd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
(2-4 mils dry per coat)

Alternate:
1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51 Series
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
(4 mils wet, 1.4 mils dry per coat)

b. Semi-Gloss Finish

1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51 Series
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
3rd Coat: S-W Pro Industrial™ Acrylic Semi-Gloss, B66-650 Series
(2-4 mils dry per coat)

Alternate:
1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51 Series
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.5 mils dry per coat)

c. Eg-Shel Finish

1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51 Series
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
3rd Coat: S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
(2-4 mils dry per coat)

Alternate:
1st Coat: S-W Pro Industrial Heavy Duty Block Filler, B42-150
(75-100 sq ft/gal)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
(4 mils wet, 1.7 mils dry per coat)

Microbicidal† Finish
1st Coat: S-W Multi-Purpose Latex Primer/Sealer, B51 Series
(4 mils wet, 1.4 mils dry)
2nd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
3rd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
(4 mils wet, 1.8 mils dry per coat)

** NOTE TO SPECIFIER** †Paint Shield® Microbicidal Paint is the first EPA-registered paint that kills greater than 99.9% *Staphylococcus aureus* (Staph), *Enterobacter aerogenes,* Methicillin-resistant *Staphylococcus aureus (MRSA)*, Vancomycin-resistant *Enterococcus faecalis* (VRE), and *Escherichia coli* (E.coli) within 2 hours of exposure on a painted surface.

F. DRYWALL - (Walls, Ceilings, Gypsum Board, etc.)

1. Latex Systems

a. Gloss Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Gloss, B21-12600 Series
(4 mils wet, 1.4 mils dry per coat)

Alternate:
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
3rd Coat: S-W Pro Industrial™ Acrylic Gloss, B66-600 Series
(2-4 mils dry per coat)

b. Semi-Gloss Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
(4 mils wet, 1.5 mils dry per coat)

Alternate:
1st Coat: S-W Harmony Interior Latex Primer, B11
(4 mils wet, 1.3 mils dry)
2nd Coat: S-W Harmony Interior Latex Semi-Gloss, B10 Series
3rd Coat: S-W Harmony Interior Latex Semi-Gloss, B10 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
(2-4 mils dry per coat)

F. DRYWALL - (Walls, Ceilings, Gypsum Board, etc.)
1. Latex Systems

c. Eg-Shel Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series
3rd Coat: S-W ProMar 200 HP Zero VOC Latex Eg-Shel, B20-1900 Series
(4 mils wet, 1.7 mils dry per coat)

1st Coat: S-W Harmony Interior Latex Primer, B11
(4 mils wet, 1.3 mils dry)
2nd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
3rd Coat: S-W Harmony Interior Latex Eg-Shel, B9 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
3rd Coat: S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
(2-4 mils dry per coat)

Microbicidal† Finish
1st Coat: S-W Harmony Interior Latex Primer, B11
(4 mils wet, 1.3 mils dry)
2nd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
3rd Coat: S-W Paint Shield® Interior Latex Eg-Shel, D12W00051
(4 mils wet, 1.8 mils dry per coat)

** NOTE TO SPECIFIER** †Paint Shield® Microbicidal Paint is the first EPA-registered paint that kills greater than 99.9% *Staphylococcus aureus* (Staph), *Enterobacter aerogenes,* Methicillin-resistant *Staphylococcus aureus (MRSA)*, Vancomycin-resistant *Enterococcus faecalis* (VRE), and *Escherichia coli* (E.coli) within 2 hours of exposure on a painted surface.

d. Low Sheen/Low Gloss Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss, B41-2600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss, B41-2600 Series
(4 mils wet, 1.6 mils dry per coat)

Alternate:
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 HP Zero VOC Latex Low Gloss Eg-Shel, B41-1900 Series
3rd Coat: S-W ProMar 200 HP Zero VOC Latex Low Gloss Eg-Shel, B41-1900 Series
(4 mils wet, 1.7 mils dry per coat)

F. DRYWALL - (Walls, Ceilings, Gypsum Board, etc.) (Cont.)

1. Latex Systems

e. Flat Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series
3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series
(4 mils wet, 1.4 mils dry per coat)

Alternate:
1st Coat: S-W Harmony Interior Latex Primer, B11
(4 mils wet, 1.3 mils dry)
2nd Coat: S-W Harmony Interior Latex Flat, B5 Series
3rd Coat: S-W Harmony Interior Latex Flat, B5 Series
(4 mils wet, 1.7 mils dry per coat)

Alternate:
1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W Pro Industrial™ DTM Acrylic Primer/Finish, B66-11
3rd Coat: S-W Pro Industrial™ DTM Acrylic Primer/Finish, B66-11
(5-10 mils wet, 1.9-3.9 mils dry)

2. Epoxy System

a. Gloss Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Gloss, B73-300 Series
(2 - 5 mils dry per coat)

b. Eg-Shel Finish

1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
(4 mils wet, 1.0 mils dry)
2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
3rd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series
(2 - 5 mils dry per coat)

2.4 MATERIALS - GENERAL REQUIREMENTS

A Paints and Coatings - General:

1 Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such a procedure is specifically described in manufacturer's product instructions. VOC numbers used in this document need to be confirmed by using the products EDS sheets.

2 Requirements:
Complies with California Department of Health Services' "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers" Version 1.1-2010 & V1.2-2017

B Primers:

1 Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.5 ACCESSORIES

A Coating Application Accessories:

1 Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A Do not begin application of coatings until substrates have been properly prepared. Notify Architect of unsatisfactory conditions before proceeding.

B If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

D Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

*(**Specifier Note**: Verify the existence of lead based paints on the project. Buildings constructed after 1978 are less likely to contain lead based paints. If lead based paints are suspected on the project, all removal must be done in accordance with the EPA Renovation, Repair and Painting rule and all applicable state and local regulations. State and local regulations may be more strict than those set under the federal regulations Verify that Owner has completed a Hazardous Material Assessment Report for the project prior to issuing of Drawings. Concluding that no lead based paints were found on project site, delete paragraph regarding lead based paints.)*

3.2 SURFACE PREPARATION

WARNING! Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted respirator (**NIOSH** approved) and proper containment and cleanup. For more information, call the National Lead Information Center at **1-800-424-LEAD** (in US) or contact your local health authority. Removal must be done in accordance with EPA Renovation, Repair and Painting Rule and all related state and local regulations. Care should be taken to follow all state and local regulations which may be more strict than those set under the federal RRP Rule.

A Proper product selection, surface preparation, and application affect coating performance. Coating integrity and service life will be reduced because of improperly prepared surfaces. Selection and implementation of proper surface preparation ensures coating adhesion to the substrate and prolongs the service life of the coating system.

B Selection of the proper method of surface preparation depends on the substrate, the environment, and the expected service life of the coating system. Economics, surface contamination, and the effect on the substrate will also influence the selection of surface preparation methods.

C The surface must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

D Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.
Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

E No painting should take place when the interior temperature is below 50°F unless the specified product is designed for these conditions.

F Methods

1 Aluminum
Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.

2 Block (Cinder and Concrete)
Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F unless the manufactures products are designed for application prior to the 30-day period. The pH of the surface should be between 6 and 9, and moisture content must be 15% or lower. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement patching compound. Masonry surfaces must be dry before priming.

3 Concrete, SSPC-SP13 or NACE 6
This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

4 Cement Composition Siding/Panels
Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Pressure clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.

5 Drywall—Interior
Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

6 Galvanized Metal
Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP16 is necessary to remove these treatments.

7 Plaster
Must be allowed to dry thoroughly for at least 30 days before painting, unless the manufactures products are designed for application prior to the 30-day period. Room must be ventilated while drying; in cold, damp weather, rooms must be heated. Damaged areas must be repaired with an appropriate patching material. Bare plaster must be cured and hard. Textured, soft, porous, or powdery plaster should be treated with a solution of 1-pint household vinegar to 1 gallon of water. Repeat until the surface is hard, rinse with clear water and allow to dry.

8 Steel: Structural, Plate, etc.
Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.

9 Solvent Cleaning, SSPC-SP1
Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.

10 Hand Tool Cleaning, SSPC-SP2
Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1 or other agreed upon methods

11 Power Tool Cleaning, SSPC-SP3
Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1 or other agreed upon methods.

12 Commercial Blast Cleaning, SSPC-SP6 or NACE 3
A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent (33%) of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.

13 Power Tool Cleaning to Bare Metal, SSPC-SP11
Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.

14 Water Blasting, NACE Standard RP-01-72
Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

15 Wood
Must be clean and dry. Knots and pitch streaks must be scraped, sanded, and spot primed before a full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth.

3.3 INSTALLATION

A Apply all coatings and materials with the manufacturer’s specifications in mind. Mix and thin coatings according to manufacturer’s recommendation.

B Do not apply to wet or damp surfaces.
1 Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer’s procedures to apply appropriate coatings prior to 30 days.
2 Test new concrete for moisture content.
3 Wait until wood is fully dry

C Apply coatings using methods recommended by manufacturer.

D Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E Apply coatings at spreading rate required to achieve the manufacturer’s recommended dry film thickness.

F Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to the application of each coat.

3.4 PROTECTION

A Protect finished coatings from damage until completion of project.

B Touch-up damaged coatings after substantial completion, following manufacture's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

3.5 SCHEDULES

Specifier Note: Cut and paste the coatings system schedule here (specified in section 2.3 INTERIOR PAINT SCHEDULE), otherwise delete this section.

END OF SECTION011312018

Product names, logos, brands and other trademarks are the property of their respective trademark holders.

The products listed on this page have been independently certified by UL Environment in accordance with “UL 2818 – GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings, ” and/or comply with California Department of Public Health “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1” (CA Section 01350) &V1.2-2017. For more information, see https://spot.ulprospector.com.

PRODUCTS	**GREENGUARD Gold**	**CDPH (CA01350) Method V1.1-2010**
ArmorSeal 8100 B70-8100/8160 Series	Certified	YES
ColorCast Ecotoners™	Certified	YES
Drywall Primer, B28W08150	Certified	YES
EcoSelect Interior Flat, Eg-Shel, Semi-Gloss, A21, A22 & A20 Series	Certified	YES
Emerald® Interior Flat & Matte, K35 & K36 Series	Certified	YES
Emerald® Interior Satin & Semi-Gloss K37 & K38 Series	Certified	YES
Eminence™ Ceiling Paint, A27	Certified	YES
Extreme Bond™ Bonding Primer, B51W150	Certified	YES
Harmony® Interior Latex Flat, Eg-Shel & Semi-Gloss B5, B9 & B10 Series	Certified	YES
Harmony® Interior Latex Primer, B11	Certified	YES
Loxon® Conditioner A24-1100 Series	Certified	YES
Loxon® Concrete & Masonry Primer	Certified	YES
Multi-Purpose Latex Primer, B51-450 series	Certified	YES
Multi-Purpose Waterbased Acrylic-Alkyd Primer, B79W450	Certified	YES
Paint Shield® Microbicidal Paint, D12W51	Certified	YES
PrepRite® ProBlock® Latex Primer, B51-620 Series	Certified	YES
ProMar® 200 HP Zero VOC Interior Acrylic Eg-Shel, B20-1950 Series	Certified	YES
ProMar® 200 HP Zero VOC Interior Acrylic Low Gloss Eg-Shel, B41-1950 Series	Certified	YES
ProMar® 200 Zero VOC Interior Latex Eg-Shel, B20-2600 &12600 Series	Certified	YES
ProMar® 200 Zero VOC Interior Latex Flat, B30-2600/12600 Series	Certified	YES
ProMar® 200 Zero VOC Interior Latex Low Gloss Eg-Shel, B41-2600 Series	Certified	YES
ProMar® 200 Zero VOC Interior Latex Low Sheen, B24-2600 Series	Certified	YES
ProMar® 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series	Certified	YES
ProMar® 200 Zero VOC Interior Latex Gloss, B21-12600 Series	Certified	YES
ProMar® 200 Zero VOC Primer, B28W2600	Certified	YES
ProMar® 400 Zero VOC Interior Latex Eg-Shel, B20-4600 Series	Certified	YES
ProMar® 400 Zero VOC Interior Latex Flat, B30-4600 Series	Certified	YES
ProMar® 400 Zero VOC Interior Latex Low Sheen, B24-4600 Series	Certified	YES
ProMar® 400 Zero VOC Interior Latex Semi-Gloss, B31-4600 Series	Certified	YES
ProMar® 400 Zero VOC Interior Latex Gloss, B21-4650 Series	Certified	YES
ProMar® 400 Zero VOC Primer, B28W4600	Certified	YES
ProMar Ceiling Paint, A27W5050	Certified	YES
Pro Industrial™ Acrylic, Gloss, Semi-Gloss & Eg-Shel, B66-600 Series	Certified	YES
Pro Industrial™ DTM Primer/Finish, B66-11	Certified	YES
Pro Industrial™ Heavy Duty Block Filler, B42W00150	Certified	YES
Pro Industrial™ Pro-Cryl® Universal Primer Off White, Medium Grey & Red Oxide B66-1300/1320 Series	Certified	YES
Pro Industrial™ Water Based Catalyzed Epoxy, B73-300 Series	Certified	YES
Quick Dry Stain Blocking Primer, B51W8670	Certified	YES
Solo® Interior/Exterior Flat, Eg-Shel, Satin, Semi-Gloss & Gloss, A74, A75, A73, A76 & A77-51 Series	Certified	YES
Tuff Surface™ Knock Down Flat & Eg-Shel Texture, A44W50	Certified	YES
Water Blocking Primer/Finish, B72W8010	Certified	YES
Waterborne Acrylic DryFall -Eg-Shel White, B42W82	NO	YES
Waterborne Acrylic DryFall -Flat White, B42W181	NO	YES
Waterborne Acrylic DryFall -Semi-Gloss White, B42W83	NO	YES
PrepRite ProMar Block Filler B25W25	NO	YES

EXHIBIT F

Green Programs Specifications

Below are Finishing Schedules furnished as a guide for specifying paint and coating systems for green programs. These specifications are written in CSI format and can be included in their entirety, or selectively, in a master specification. As with any standard specifications, they should be reviewed by the Specifier and edited to suit the particular needs of a given project and its respective location.

Specifications Documents: (Save the .zip or .sit to your computer, then extract the Word document to view or edit.)

On a mobile device?
You'll need to download a file extractor to unzip and view specifications documents. Examples include

Zip File Viewer
for iPhone.

Astro File Manager
for Andriod and

FileScoutLight
for Blackberry.

Green Programs Specifications

These specification guides include Sherwin-Williams products that contributes toward satisfying the criteria under the credit category designated below.

09 91 23 LEED v4 & v4.1 BD&C Building Design and Construction
Contributes toward satisfying Indoor Environmental Quality EQ Credit: Low-Emitting Material
PDF - 134KB | DOC - 232KB

09 91 23 Green Globes for New Construction (NC) v1.45
Contributes toward satisfying 3.7.2.1.3 Volatile Organic Compounds
PDF - 121KB | DOC - 224KB

09 91 23 CDPH v1.1-2010 & v1.2-2017 California Department of Health Services
"Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1" (CA Section 01350) & V1.2-2017
PDF - 113KB | DOC - 227KB

09 91 23 NGBS National Green Building Standard™ ICC/ASHRAE 700-2015
Contributes toward satisfying 901.9 Interior Architectural Coatings
PDF - 114KB | DOC - 223KB

EXHIBIT G

your guide to

LOW- AND ZERO-VOC PAINTS

From *Better Homes and Gardens*® magazine

Emitted from paint as potentially harmful gases, volatile organic compounds, or VOCs, are a hot—and rather complicated—topic when it comes to indoor air quality. Manufacturers have developed paints with reduced VOCs to meet consumer demand and industry regulations, which vary across the country.

Not surprisingly, paint comes in many shades of green. To compare, start with the VOC content found on paint can labels. The lower the number, the better. The number generally accepted for a low-VOC paint is less than 50 grams per liter; a zero-VOC paint has fewer than 5 grams per liter. In general, lower VOC amounts are found in paint that is latex (rather than alkyd), with a flat (rather than glossy) sheen, and is a light color, but individual formula variations can make it difficult to compare. In all cases, though, VOC amounts on labels don't currently include VOCs in colorants added at the store. For independent certifications and standards, see *greenseal.org* and *greenguard .org* (which measures VOC emissions).

Use this chart to help you compare your options. Only companies with verified information on paint that has a VOC content of 50 grams per liter or less are included. Information is subject to change; be sure to check each manufacturer's Web site for the most current information.

COMPANY	PAINT COLLECTION(S)	VOC CONTENT (grams per liter)	APPROXIMATE PRICE (per gallon)	FOR MORE INFORMATION
AFM - American Formulating and Manufacturing	Safecoat	0	\$32–\$42	800/239-0321; afmsafecoat.com
AkzoNobel Decorative Paints US	The Freshaire Choice	0	\$35–\$38, only at Home Depot	866/880-0304; thefreshairechoice.com
Anna Sova Luxury Organics	Anna Sova Healthy Paint	0	\$69	214/742-7682; annasova.com
BEHR Process Corp.	BEHR Premium Plus Interior	<50	\$28	877/237-6158; behr.com
Benjamin Moore & Co.	Aura	<50	\$55	888/262-6567; myaurapaint.com
BioShield Paints	Solvent Free Wall Paint; Casein Milk Paint; Clay Paint; Kinder Paint	0 (in each collection)	\$35–42; \$35 for 1.5 gallons; \$42; \$42	800/621-2591; bioshieldpaint.com
Devine Color	Devine Color; devinegreen	<50; 1.4	\$38–\$40, \$40	503/387-5840; devinecolor.com
Dunn-Edwards	EcoShield (flat, low sheen, semigloss); Walltone latex (flat); Decovel latex (flat); Suprema latex (low sheen)	From <8 to 50, depending on collection & sheen	\$34–48, \$28; \$35; \$41	dunnedwards.com
Duron Paints & Wallcoverings	Genesis Odor-Free	10–44, depending on sheen	\$37–\$41	800/723-8766; duron.com
Dutch Boy	Clarity Interior Latex; Kid's Room	0; 5–32	\$25–\$29; from \$21	800/828-5669; dutchboy.com
Eco-Trend Corp.	Eco-Trend Collagen	0	\$32–\$35	888/889-5925; ecotrendlife.com
Farrow & Ball	Estate Emulsion (flat); Modern Emulsion (slight sheen); Water-Based Eggshell	0 (in each collection)	\$70; \$78; \$88	888/511-1121; farrow-ball.com
Glidden	Evermore	<50	\$17–\$23	800/454-3336; glidden.com

COMPANY	PAINT COLLECTION(S)	VOC CONTENT (grams per liter)	APPROXIMATE PRICE (per gallon)	FOR MORE INFORMATION
Green Planet Paints	Clay Paint	0	$42–$46	greenplanetpaints.com
Hirshfield's	Preserve Paint	<50	$24–25	hirshfields.com
Homestead House Paint Co.	VOC Free Interior Edition Latex	0	$60	877/886-5098; homesteadhouse.ca
McCormick Paints	Natural Odor Free; Match Point Interior Latex (flat); Tempo Interior (flat)	<5; <50; <50	$34–$39; $23–$25; $30–$33	877/724-6855; mccormickpaints.com
Miller Paint Co.	Acro Pure	0	$27–$30	800/852-3254; millerpaint.com
Mythic Paint	Mythic Paint	0	$45–$55	888/714-9422; mythicpaint.com
The Old Fashioned Milk Paint Co.	Old Fashioned Milk Paint; SafePaint	0 (in both collections)	$46; $46	866/350-6455; milkpaint.com
Olympic Paint & Stain	Olympic Premium Interior	0	from $17, only at Lowe's	800/441-9695; olympic.com
Parker Paint Mfg. Co.	Klean Air (flat, satin, semigloss)	5	$41–$44	253/473-1122; parkerpaint.com
PPG/Pittsburgh Paints	Pure Performance; Manor Hall Timeless Interior	0; <50	$25–$30; $35–$45	pittsburghpaints.com
Pratt & Lambert	Red Seal Porcelain	35.8–48.5	$29–$34	800/289-7728; prattandlambert.com
The Real Milk Paint Co.	Real Milk Paint	0	$46	800/339-9748; realmilkpaint.com
Rodda Paint Co.	Horizon	0	$28–$37	800/452-2315; roddapaint.com
Sherwin-Williams	Harmony Interior Latex; Duration Home Interior Latex (satin)	0; 17	from $36; from $43	800/474-3794; sherwin-williams.com
Sico, Inc.	Sico Design	0	$49	800/463-7426; sico.ca
Vista Paint	Earth Coat latex (flat, eggshell, semigloss); Carefree acrylic (flat and semigloss)	2–7; 44–49	$24–$28; $28–$37	714/680-3800; vistapaint.com
YOLO Colorhouse	YOLO Colorhouse Inside	0	$40	877/493-8275; yolocolorhouse.com

O1. RESPONSES TO COMMENTS FROM THE ATTORNEYS FOR THE SOUTHWEST REGIONAL COUNCIL OF CARPENTERS, MARCH 23, 2020.

O1-1 This introductory comment provides a brief summary of the proposed project and introduces the Southwest Regional Council of Carpenters (Southwest Carpenters). The commenter states that the Southwest Carpenters reserves the right to supplement these comments at or before hearings on the project, incorporates by reference all comments raising issues regarding the Draft EIR, and requests notification of all future notices issued under CEQA regarding the project. This comment is acknowledged and the City will send all future CEQA notices regarding the proposed project to the Southwest Carpenters.

O1-2 The commenter provides a general background on CEQA and the purpose of EIRs. No further response is required as part of the CEQA process/CEQA response to comments.

O1-3 The commenter states that the Draft EIR does not describe the project's requested entitlements. In addition to the listing of discretionary actions detailed in Section 3.5, *Intended Uses of the EIR*, of the Draft EIR, all requested City discretionary actions are specifically described as follows: General Plan Amendment (Draft EIR page 3-7), Zone Change (Draft EIR page 3-7), Specific Plan (Draft EIR pages 3-7 through 3-21), Master Plan (Draft EIR pages 3-22 through 3-26), Development Agreement (Draft EIR page 3-26), Tentative Tract Map (Draft EIR page 3-26), Tree Removal Permit (Draft EIR page 3-26), and Public Art Plan (Draft EIR page 3-13).

Additional discretionary approvals from responsible agencies are also listed under Draft EIR Section 3.5, *Intended Uses of the EIR*. These approvals are discussed in the appropriate sections of the Draft EIR. For example, the issuance of a National Pollution Discharge Elimination System Permit is discussed in Draft EIR Section 5.8, *Hydrology and Water Quality*, and approval of proposed sewer improvements by the Orange County Sanitation District and Costa Mesa Sanitary District are discussed in Draft EIR Section 5.15, *Utilities and Service Systems*.

The commenter also states that the list is non-exhaustive and are in addition to "non-descript" ministerial actions. CEQA Guidelines Section 15124(d)(1) states that the project description is required to include a brief statement describing the intended uses of the EIR, to the extent that the information is known to the Lead Agency. The listed agencies, permits, and approvals in the Draft EIR are those known to the City of Costa Mesa at this time and thus, meet the requirement under CEQA Guidelines Section 15124(d)(1).

O1-4 The commenter states that an EIR must describe all feasible mitigation measures to reduce a project's potentially significant impacts and that a statement of overriding considerations is required should a project result in significant and unavoidable impacts. This comment is noted; no further response is required as part of the CEQA process/CEQA response to comments.

O1-5 The commenter states that the Draft EIR does not mitigate the project's significant and unavoidable GHG emissions, and the Draft EIR must analyze the effectiveness and feasibility of several GHG mitigation measures proposed by the California Air Pollution Control Officers Association's *Quantifying*

2. Response to Comments

Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures (CAPCOA Report), dated August 2010.

The proposed project includes project design features that would reduce GHG emissions by reducing energy and water use, increasing electric vehicle use, and reducing vehicle miles traveled by encouraging alternative transportation modes and ridesharing. These project design features are included in the CAPCOA Report and are consistent with the California Green Building Standards Code (CALGreen), the latest 2019 Title 24 Building Energy Efficiency Standards, and the California Climate Change Scoping Plan. In addition, because of the project's urban infill location, its access to public transportation within a quarter mile of the project site, and its proximity to other destinations including off-site residential, restaurants, and retail, the project-generated vehicle miles traveled and associated GHG emissions would be reduced. Mitigation Measures GHG-1 and GHG-2 would further incentivize the use of electric vehicles and reduce GHG emissions. With the implementation of the project design features and mitigation measures, the proposed project has included all the feasible on-site measures.

The commenter also suggests further reducing GHG emissions by undertaking off-site mitigation measures or obtaining GHG emission credits. Off-site mitigation measures and GHG emissions credits are not feasible. The majority of the project's GHG emissions would be generated from tail pipe emissions (i.e., mobile sources). However, all California-based refineries are subject to the State's Cap-and-Trade Program and the project would "double count" if offset mitigation credits were utilized. Additionally, the primary market for GHG offset mitigation in California is the State's Cap-and-Trade Program; thus, the majority of offsets in California are specifically designed for the "compliance offsets" market and are not available for project-level CEQA mitigation. To meet the additional requirements under CEQA, GHG offsets must come from the Voluntary Offset Program. Currently, there is insufficient voluntary offsets in the State to satisfy CEQA demand and is cost prohibitive. Lastly, Forward Mitigation Units (FMUs) are available, but FMUs go towards future programs that implement GHG reductions and are not tied to offsetting emissions associated with a specific project (i.e., the proposed project). Therefore, that additional off-site mitigation is infeasible.

O1-6 The commenter states that the Draft EIR failed to discuss all feasible air quality mitigation measures. Specifically, the commenter suggests that the Draft EIR should discuss the infeasibility of using Tier 4 construction equipment. As stated on Draft EIR page 5.2-32, "Mitigation Measure AIR-1 would require the construction contractor to utilize newer, Tier 3, construction equipment fitted with Level 2 diesel particulate filters (DPF), which would reduce NO_X and PM emissions." Further, as shown on Draft EIR page 5.2-33, the project's construction-related nitrogen oxides (NOx) and particulate matter (i.e., PM_{10} and $PM_{2.5}$) emissions would be less than significant with implementation of Mitigation Measure AIR-1. Therefore, additional mitigation measures that would provide more stringent requirements as suggested by the commenter are not required.

The commenter also suggests that the Draft EIR should discuss the infeasibility of using "Zero VOC" paints (i.e., coatings with less than 5 grams of VOC per liter). Utilization of "Zero VOC" paints is not feasible because these paints are limited to brush-type application rather than spray and it would not be feasible to paint all of the project's proposed buildings and structures by brush. "Low VOC" paints (i.e., coatings with less than 50 grams of VOC per liter) are the best available paints that can be sprayed. Mitigation Measure AIR-2 already requires the use of paints with low VOC content with a maximum concentration of 30 grams per liter. It should be noted that the CalEEMod output files provided in the Draft EIR incorrectly omitted implementation of Mitigation Measure AIR-2 (paints with a maximum concentration of 30 grams of VOC per liter) in the mitigated model run. Remodeling of the mitigated construction emissions shows that VOC emissions would be reduced to 78 pounds per day, which would continue to exceed the SCAQMD's 75 pounds per day threshold; refer to Appendix F-3. Thus, impacts in this regard would remain the same as analyzed in the Draft EIR.

O1-7 According to the Department of Toxic Substances Control (DTSC), dry-land farming is the practice of growing a crop without irrigation.[1] Many dry-land farming fields are not treated with pesticides or infrequently treated, since the lack of water does not provide a desirable habitat for most agricultural pests. Properties that clearly qualify as dry-land farming do not need further investigation for pesticides or metals. Thus, within the scope of the ASTM International (ASTM) E 1527-13 Standard Practice, it is reasonable for the Environmental Professional to determine that past on-site dry farming practices would not result in Recognized Environmental Condition (REC).

Regarding the past use by Nissan Motor Corporation, the Phase I ESA was performed in general accordance with ASTM E 1527-13, which included agency record requests, reviewing owner and client questionnaires/interviews, Environmental Data Resources, Inc. (EDR) database records search, and performing a site reconnaissance. Based on data to date and the opinion of the Environmental Professional (defined by ASTM E 1527-13), there is no evidentiary basis pertaining to the Nissan Motor Corporation being considered a REC at the project site.

According to the Phase I ESA (Appendix G, *Phase I Environmental Site Assessment Report*, of the Draft EIR), an oil-interceptor was removed from the project site in November 2010. No evidence of a release was noted in the report. At the time of removal, one soil sample was collected beneath the oil-interceptor, which indicated that total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs) were less than the reporting limits (non-detect). Additionally, metal concentrations in the sample were less than concentrations typical for Southern California soils. Reportedly, the Orange County Sanitation District (OCSD) oversaw the backfilling and capping of the interceptor and associated floor drains. Based on the size of the oil-interceptor, laboratory test results, and lack of inclusion on any release-related environmental databases reviewed, conditions related to the removal of this oil-interceptor do not suggest conditions that would be likely to have caused an adverse environmental impact at the project site. Based on this information, it is the opinion of the Environmental Professional (defined by ASTM E 1527-13) that site conditions related to the removal of the oil-interceptor do not cause a REC at the project site. The City's experts disagree with the commentator.

[1] Department of Toxic Substances Control, *Interim Guidance for Sampling Agricultural properties (Third Revision)*, August 7, 2008.

2. Response to Comments

Notwithstanding, while no RECs were identified, Section 5.7, *Hazards and Hazardous Materials*, of the Draft EIR acknowledged that the historical uses of the project site could have resulted in limited soil contamination of hazardous substance and/or petroleum products. Therefore, excavation and grading activities could encounter releases of hazardous substances and/or petroleum products. Implementation of Mitigation Measures HAZ-1 and HAZ-2 would ensure the safe handling of any suspicious soil or unknown features (including potential contaminated soils from historic agricultural uses) that may be encountered during grading activities. If encountered, these areas of concern would be assessed by a qualified environmental professional and handled per the requirements of the Soil Management Plan and its performance criteria as outlined in Mitigation Measure HAZ-1. Overall, the project's use, storage, transport, and disposal of hazardous materials or reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment would be required to conform to existing laws and regulations and project-specific mitigation measures (refer to PPP HAZ-1 and PPP HAZ-2 and Mitigation Measures HAZ-1 and HAZ-2). Compliance with applicable laws and regulations governing the use, storage, transportation, and disposal of hazardous materials would ensure all potentially hazardous materials are used and handled in an appropriate manner and would minimize the potential for safety impacts.

O1-8 The commenter requests that the City revise and recirculate the Draft EIR to address the issues raised in the comment letter. CEQA Guidelines Section 15088.5 requires a Lead Agency to "recirculate an EIR when significant new information is added to the EIR after public notice is given of the availability of the Draft EIR for public review under Section 15087 but before certification. New information added to an EIR is not 'significant' unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project's proponents have declined to implement." This comment letter and responses to the comments in this letter do not identify any significant new information requiring recirculation. As such, recirculation of the Draft EIR is not required.

COMMENT LETTER O2

Attn: One Metro West Draft EIR
Minoo Ashabi, Principal Planner
City of Costa Mesa
Development Services Department
77 Fair Drive
Costa Mesa, CA 92626

RECEIVED
MAR 2 0 2020
City of Costa Mesa
Development Services
Department

The Board of Directors of Mesa Verde Community Inc (MVCI) thanks you for the opportunity to submit comments on the Draft Environmental Impact Report (DEIR) for the One Metro West Project.

After careful review and consideration of the DEIR, it is our position the only rational selection for the proposed project is the **NO PROJECT/NO DEVELOPMENT ALTERNATIVE.** This recommendation is based primarily on the Unavoidable Adverse Impacts (Air Quality, Greenhouse Gas Emissions, and Transportation) presented in the DEIR and the need for multiple amendments to the Costa Mesa General Plan. O2-1

The following details our major review comments on the DEIR:

AESTHETICS – Mesa Verde is the residential community that will be most impacted by the proposed project. We are located immediately south of the I-405 freeway within a few hundred feet of the proposed multi-story parking and residential units. Currently, the existing one-story building on the property is visible to us. Presently, the project location is zoned Industrial Park (MP) and would only allow a maximum three-story (45- foot) building. The proposed project calls for six to seven story buildings that would be at least 67 feet high and up to 90 feet at building C, therefore requiring a zoning change. **AESTHETICALLY THESE BUILDINGS WOULD DOMINATE VIEWS TO THE NORTH.** O2-2

PROJECT ALTERNATIVES – As required by the California Environmental Quality Act (CEQA), the DEIR includes the presentation of alternatives to the proposed project. The DEIR presents a Reduced Development Intensity Plan and the No Project/No Development Alternative. The Reduced Development Intensity Plan would reduce the number of rental units from 1057 to 845. However, along with the reductions of 212 units, the developer has removed many of the improvements presented in the preferred plan such as open space/park area, street and bicycle path upgrades etc. This suggests an attitude *"If I can't get what I want, I'm going to make somebody pay."* **WE DO NOT BELIEVE THIS TO BE A VIABLE REDUCED PROJECT ALTERNATIVE FOR THE CITY AND RESIDENTS OF COSTA MESA.** O2-3

ZONING AND GENERAL PLAN AMENDMENTS – The proposed project requires a zoning change and multiple amendments to the Costa Mesa General Plan. **WE DON'T BELIEVE THESE CHANGES ARE BENEFICIAL TO THE PEOPLE OF MESA VERDE OR THE RESIDENTS OF COSTA MESA.** O2-4

TRANSPORTATION – The DEIR identifies intersections in the project area as not conforming to the Orange County Congestion Management Plan Level of Service (LOS) during peak periods. The goal is LOS D or less. Some intersections are already level F during peak periods. The increased traffic due to the project is written-off by the developers as *"…no big deal. The intersections are already nonconforming and the project is not making the designations worse. Therefore, the project really isn't impacting traffic."* However, they identify Transportation as an Unavoidable Adverse Impact. **THIS IS NOT ACCEPTABLE.** O2-5

GENERAL PLAN AMENDMENTS – The proposed project is inconsistent with the following Costa Mesa General Plan Policies:

POLICY LU-1.3 *"……encourages owner occupied housing."* The One Metro West project is entirely rental units and therefore inconsistent with the Costa Mesa General Plan.

POLICY C-3.1 *"……compliance with the Orange County Congestion Management Plan…"* One Metro West is not in compliance with the Plan.

POLICY C-3.8 *"…Maintain or improve mobility within the City to achieve a standard level of service no worse then D…"* One Metro West will not improve mobility. The addition of traffic from the development would not change the LOS at critical intersections at peak hours. These intersections are areas currently out of compliance (level F) with the General Plan. Even though the LOS designation will not change, the additional traffic from the project will further the adverse impacts at these intersections. O2-6

POLICY GM-2.5 *"…the project does not place greater impact on the circulation system…"* As stated above and in the DEIR, the project will add vehicular traffic to the already nonconforming intersections, therefore IT WILL IMPACT THE CIRCULATION SYSTEM.

OPEN SPACE – The areas designated as open space for the proposed project is significantly less than required in the General Plan and even further reduced for the Reduced Development Intensity Plan. **THIS IS NOT ACCEPTABLE.** O2-7

CURRENT USE OF PROPERTY – DEIR Page 5.7-8 Subsection 5.7.1.2 "Current Use of Property" 1st paragraph *"….The building is occupied by Sakura Paper Factory, Robinson Pharma, South Coast Baking, and Dektra-Lite Industries Inc."* The DEIR section provides a discussion of Robinson Pharma, South Coast Baling and Dektra-Lite Industries, Inc. Why is there no discussion of Sakura Paper Factory? O2-8

DEIR Appendix G, Phase I Environmental Site Assessment Report (Phase I). The Phase I report also provides more detailed background information on Robinson Pharma, South Coast Baking and Dektra-Lite Industries Inc. but again fails to provide required information on Sakura Paper. Furthermore, in a letter from the Department of Toxic Substances Control (DTSC) dated June 13, 2019, they specifically request information be provided on the processes used at Sakura Paper. As such, the Phase I ESA is deficient and non-responsive to the regulatory agency. **THE OVERSIGHT OF SAKURA PAPER FACTORY MAKES THE DEIR AND THE PHASE I INCOMPLETE AND UNACCEPTABLE.** O2-8 cont'd

APPENDIX G, PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT – An important part of a Phase I is a discussion of the past and current history of the subject property. This information is collected from many sources including historical aerial photographs, topographic maps, records researches of past ownership etc. An important part of this information also comes from direct interviews with individuals (i.e. past owners/operators, workers, real estate sales individuals familiar with the project) to understand the processes used at the property over time. This information is usually collected by the firm hired to conduct the Phase I (Geocon). In this instance, much of the information was provided by Mr. Leonard Glickman, an employee of Rose Equities (the developer). **IN MOST CASES THIS WOULD BE PROFESSIONALLY UNACCEPTABLE AND UNETHETICAL AND THE PHASE I WOULD BE REJECTED. WE ALSO CONSIDER THIS TO BE A MAJOR CONFLICT OF INTEREST.** O2-9

Respectfully Submitted,

Terry R. Wall

Mr. Terry R. Wall
President, Mesa Verde Community Inc.

O2. RESPONSES TO COMMENTS FROM MESA VERDE COMMUNITY INC., MARCH 20, 2020.

O2-1 This introductory comment from the Mesa Verde Community Inc. generally opposes development of the project, and prefers the No Project/No Development Alternative considered in the Draft EIR, based on the significant and unavoidable impacts related to air quality, greenhouse gas emissions, and transportation, and the need for multiple amendments to the *City of Costa Mesa General Plan* (General Plan). Reponses to specific comments within this letter are provided below.

O2-2 The commenter is concerned the proposed buildings would dominate views looking north towards the project site from the Mesa Verde neighborhood located south of the I-405 Freeway. Building A (nearest the Mesa Verde neighborhood, greater than 200 feet away) would have a maximum building height of six stories; Buildings B and C would have maximum building heights of seven stories; and the Creative Office Building would have a maximum building height of three stories. Private views, as seen from the Mesa Verde neighborhood are not public scenic vistas. Pursuant to the CEQA Guidelines, in urbanized areas, consideration of the project's potential to conflict with applicable zoning and other regulations governing scenic quality were considered, including building heights. As detailed in Draft EIR Section 5.1, *Aesthetics*, Impact 5.1-1, Operations, the proposed Specific Plan's design and development standards would regulate the project's building height. Specific development standards and design guidelines are proposed for site design, building architecture (including articulation), and landscaping that would soften the structural appearance of the proposed buildings and provide a unified appearance for the overall development. As detailed in Draft EIR Table 5.1-1, *Project Consistency with the Costa Mesa General Plan*, the proposed project would be consistent with relevant General Plan goals, objectives, and policies pertaining to scenic quality (including consideration of proposed building heights as applicable). Impacts regarding the potential to conflict with applicable zoning and other regulations governing scenic quality were determined to be less than significant.

O2-3 The commenter does not believe the Reduced Development Intensity Alternative is a viable project alternative given that the alternative would eliminate many of the project's open space and recreational amenities. Per CEQA Guidelines Section 15126.6(a), "an EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." The Reduced Development Intensity Alternative was selected to avoid or substantially lessen the proposed project's significant unavoidable impacts related to air quality, greenhouse gas emissions, and transportation. By reducing the number of residential units by 20 percent while still maintaining a proportional number as affordable units, many of the public amenities would need to be reduced or eliminated to make the alternative feasible to construct. As such, this alternative is a reasonable and feasible alternative to analyze in Chapter 7, *Alternatives*, of the Draft EIR.

O2-4 The commenter states that the project's proposed Zone Change and General Plan Amendment would not be beneficial to the residents of Costa Mesa. The environmental impacts of the proposed discretionary actions are analyzed in Draft EIR Section 5.9, *Land Use and Planning*. This comment is a general opposition to the requested entitlements and thus, is not related to the adequacy of the Draft EIR analysis. No additional response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

O2-5 The commenter suggests that any roadway intersections currently operating at level of service (LOS) F during peak periods that would be further impacted by the proposed project would be a significant impact. As defined in Section 5.13, *Transportation*, of the Draft EIR, a project would have a significant impact at a signalized intersection if the project causes the LOS at an intersection to deteriorate from D to E or F, or if an intersection already operates at LOS E or F and the project contributes to a volume-to-capacity ratio greater than 0.01. As for unsignalized intersections, a project is considered to have a significant impact if the project causes the LOS at an intersection to deteriorate from D to E or F, or if an intersection already operates at LOS E or F and the project contributes to the existing deficiency.

The Traffic Impact Analysis analyzes the project's incremental impact on each study area intersection based on each intersection's LOS under existing conditions. Therefore, while an intersection may operate at a LOS F under future short-term (2027) cumulative plus project or General Plan buildout (2040) plus project conditions, the project would not result in a potentially significant impact if the aforementioned thresholds for signalized and unsignalized intersections are not met.

It should be noted that the commenter is correct in stating that the Draft EIR concluded significant and unavoidable impacts regarding transportation. The significant and unavoidable impacts are related to Study Intersection No. 18 (Susan Street/South Coast Drive), Study Intersection No. 28 (Talbert Avenue/Mt. Washington Street), twelve freeway segments and ramps, and increased office-related vehicle miles traveled (VMT); refer to Draft EIR Chapter 6, *Significant Unavoidable Adverse Impacts*. The City of Costa Mesa would be required to make a Statement of Overriding Considerations pertaining to the project's significant and unavoidable transportation impacts in order to approve the project.

O2-6 The commenter states that the project would be consistent with all applicable General Plan goals and policies with the exception of Policies LU-1.3, C-3.1, C-3.8, and GM-2.5; refer to Draft EIR Table 5.9-1, *Project Consistency with General Plan*. Policy LU-1.3 encourages residential development and owner-occupied housing to improve the balance between rental and ownership housing opportunities within the City. This policy is not related to the environmental effects of the proposed project. In other words, project consistency or inconsistency with Policy LU-1.3 would not result in any difference in terms of the project's physical environmental impacts under CEQA. Policies C-3.1, C-3.8, and GM-2.5 are related to the project's consistency with established LOS standards and potential to provide economic growth without adversely impacting the City's circulation system. The project's exceedance of established LOS standards and impacts on the City's existing circulation system are fully analyzed in Draft EIR Section 5.13, *Transportation*.

It should also be noted that the General Plan includes hundreds of goals and policies, including some goals and policies which are competing policy interests. An EIR need not find that a project is consistent with each and every goal and policy in the General Plan. Rather, the City finds that although

2. Response to Comments

the project would be inconsistent with four General Plan policies, the project is consistent with the vast majority of applicable General Plan goals and policies and thus, finds that the project is consistent with the General Plan overall. As such, impacts would be less than significant as stated in the Draft EIR.

O2-7 The commenter states that the proposed 1.5-acre open space is less than required by the General Plan and is eliminated from the Reduced Development Intensity Alternative. As detailed in Section 5.12, *Public Services and Recreation*, of the Draft EIR, the City has a goal to maintain a parkland standard of 4.26 acres of parkland per 1,000 residents. The project would need to provide 12.29 acres of parkland to meet this goal. This goal is implemented through the Municipal Code requirements for compliance with the Quimby Act and payment of park impact fees. The City requires the payment of a park impact fee to meet the parkland requirement (see PPP PS-1). The project would pay the entire park impact fee, as documented through the Development Agreement, thereby satisfying the City's parkland requirement. Payment of park impact fees is adequate mitigation for purposes of CEQA compliance. Beyond satisfying the City's park impact requirements, the project proposes to provide a 1.5-acre open space area and bicycle trail amenities, which would be permanently accessible to the public, as well as private, on-site amenities for project residents.

The commenter is correct in stating that the Reduced Development Intensity Alternative would eliminate the 1.5-acre open space and several pedestrian and bicycle amenities. The impacts of the reduced parkland and recreational amenities are fully addressed in Draft EIR Chapter 7, *Alternatives*. Dedication of parkland and/or payment of parkland fees would also apply to the Reduced Development Intensity Alternative.

O2-8 The commenter questions why Sakura Paper Factory is not discussed in the Phase I Environmental Site Assessment (ESA) and Section 5.7, *Hazards and Hazardous Materials*, of the Draft EIR. As described in the Phase I ESA (Appendix G, *Phase I Environmental Site Assessment Report*, of the Draft EIR), the existing on-site building (Assessor's Parcel Number 139-031-62; 1683 Sunflower Avenue) consists of a one-story concrete tilt-up commercial building currently used as a commercial warehouse for three tenants). It is acknowledged that portions of the building are vacated, including the former Sakura Paper Factory, which has moved offices to the City of Cypress and no longer operates in the existing industrial building on-site. Based on the Environmental Data Resources, Inc. (EDR) database records search, no listings pertaining to Sakura Paper Factory were found. No reported releases of hazardous materials were reported and, other than Nissan North America, no reported listings for the storage of hazardous materials were reported on-site. Based on files requested from the Costa Mesa Fire Department, South Coast Air Quality Management District, and Orange County Health Care Agency, as well as online searches of databases maintained by the Department of Toxic Substances Control and the State Water Resources Control Board, no records pertaining to the former Sakura Paper Factory were noted. At the time of site reconnaissance, Sakura Paper Factory had vacated the premises. Regarding interviews, conducted as part of the Phase I ESA, per the ASTM International (ASTM) E 1527-13 Standard Practice, interviews with the "User" of the Phase I ESA (the applicant representative for Rose Equities), as well as the current property owner, Mr. Kurt Bruggeman with Lee & Associates were conducted. Although Mr. Bruggeman has only owned the property since December

2013, he has past knowledge of the project site, including past improvements as far back as 1975. No pertinent information regarding Sakura Paper Factory was reported as part of interviews with Mr. Bruggeman. According to the Environmental Professional, the Phase I ESA identified no evidence of RECs in connection with Sakura Paper Factory, pursuant to ASTM E 1527-13 Standard Practice, and no additional environmental assessment is warranted at this time.

Notwithstanding, Section 5.7, *Hazards and Hazardous Materials*, of the Draft EIR acknowledged that the historical uses of the project site could have resulted in limited soil contamination of hazardous substance and/or petroleum products. Therefore, excavation and grading activities could encounter releases of hazardous substances and/or petroleum products. Implementation of Mitigation Measures HAZ-1 and HAZ-2 would ensure the safe handling of any suspicious soil or unknown features (including potential contaminated soils from historic agricultural uses) that may be encountered during grading activities. If encountered, these areas of concern would be assessed by a qualified environmental professional and handled per the requirements of the Soil Management Plan and its performance criteria as outlined in Mitigation Measure HAZ-1. Overall, the project's use, storage, transport, and disposal of hazardous materials or reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment would be required to conform to existing laws and regulations and project-specific mitigation measures (refer to PPP HAZ-1 and PPP HAZ-2 and Mitigation Measures HAZ-1 and HAZ-2). Compliance with applicable laws and regulations governing the use, storage, transportation, and disposal of hazardous materials would ensure all potentially hazardous materials are used and handled in an appropriate manner and would minimize the potential for safety impacts.

It is acknowledged that the Department of Toxic Substances Control (DTSC) provided a letter, dated June 13, 2019 as part of the public review period for the Notice of Preparation (provided in Appendix B, *NOP Comments*, of the Draft EIR). At this time, the DTSC stated: "In addition to the current use of the site by Sakura paper Inc., the EIR should identify and determine whether historic uses at the project site may have resulted in any release of hazardous wastes/substances." As requested by the DTSC, a Phase I ESA was included as part of the Draft EIR to determine whether historic uses at the project site may have resulted in any release of hazardous wastes/substances pursuant to ASTM E 1527-13 Standard Practice, as discussed above. It is further acknowledged that the DTSC received the Draft EIR and did not provide a comment letter disagreeing with the Draft EIR.

O2-9 The commenter states that the Phase I ESA should be rejected due to a conflict of interest, as information regarding past and current uses of the property were provided by Rose Equities (the applicant). As discussed in response to comment O2-8, per the ASTM E 1527-13 Standard Practice, interviews should be conducted with the "User" of the Phase I ESA (in this case the applicant Rose Equities), and the current and past property owner(s) as available. In addition to the applicant representative for Rose Equities, Mr. Kurt Bruggeman with Lee & Associates (the current property owner) was also interviewed. Although Mr. Bruggeman has only owned the property since December 2013, he has past knowledge of the project site, including past improvements as far back as 1975.

2. Response to Comments

It is further acknowledged that the applicant-provided Phase I ESA was also reviewed by a third-party (Roux Associates), a subconsultant to Michael Baker international, contracted by the City of Costa Mesa, which concurred with the results of the Phase I ESA.

COSTA MESA

FIRST

Working for a Livable City

March 23, 2020

VIA EMAIL ONLY

City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

Re: Comments to Draft Environmental Impact Report prepared in connection with the One Metro West Project

Ladies and Gentlemen:

The following are our comments with respect to the Draft Environmental Impact Report for the One Metro West Project ("OMW"), which we request be made part of the public record:

Housing

The unavailability of suitable affordable housing for employees has proven to be a problem in the past for businesses because it makes it difficult to retain skilled employees. While most of OMW is market-rate housing, the proposed minimum of 105 units of affordable housing will provide some of the much-needed workforce housing in Costa Mesa. If Rose Equities (the "Developer") could include more affordable units in OMW, the business community and their employees would benefit, particularly in light of the effects of the novel coronavirus on the economy. In addition, it is important that the City be able to use those affordable units to satisfy a portion of the Regional Housing Needs Allocation. However, it is also important that the City adopt an inclusionary housing ordinance for all future projects, and we look forward to seeing a draft ordinance soon. O3-1

Traffic Mitigation and Recommended Improvements

Since the project is mixed-use, the office, retail and recreational amenities, along with the facilities at the SoCo center next door, will alleviate some of the need for OMW's residents to travel for products and services. The mitigation of the impacts of motor vehicle traffic is important because nearby projects, specifically The Press and the 405 freeway widening project,

Costa Mesa First (FPPC 1332564), P.O. Box 2282, Costa Mesa, CA 92628
costamesa1st@gmail.com
costamesa1st.com
(714) 549-5884

are not alleviating traffic impacts in the area, although the developer of The Press has reluctantly agreed to install an off-street multiuser trail replacing or adjacent to the existing spur track on its property.

In contrast, the Developer will enhance nearby bicycle and pedestrian facilities by installing upgraded paths and sidewalks and will contribute its fair share to implement recommended traffic signal improvements. It is noted that the 405 freeway project will cause the level of service at nearby freeway offramps to deteriorate, but that is not an impact caused by OMW, but rather OCTA and Caltrans' failure to recognize that widening does nothing to decrease the number of freeway users and only increases motor vehicle traffic on local streets.

Parkland

The one and one-half acres of open space that would be built and maintained by the Developer, and open to the general public, would be a unique opportunity for the City to start satisfying its goal of providing 4.26 acres of parkland per 1,000 persons. The City's General Plan assumes that at build-out the City would have a population of 131,690 residents; therefore, 561 acres would need to be acquired to achieve the City's goal. Because there is a paucity of vacant land within the City, it could be reasonably assumed that the acquisition of 561 acres of parkland would not be feasible. However, this project's new parkland should not be considered insignificant. Planning decisions have a key role to play in combating growing levels of obesity and helping prevent lifestyle-related diseases through facilitating physical activity and positive mental health and new parkland is a necessary change. We hope the City will identify and purchase additional land as it becomes available and convert those parcels to parks.

O3-1 cont'd

Noise, Light and Air Pollution

While we are concerned the residential component is near the 405 freeway, the buffer of the parking structure will help to lessen the impacts of noise and air pollution on the residents of OMW. It is noted that the Developer has agreed to "exclude the use of moving, flashing, or otherwise visually distracting elements or materials that are highly reflective or generate noise." There is a large concrete divider (the 405 freeway) between OMW and the homes in Mesa Verde, therefore it is unlikely there will be noise, light or other impacts from OMW on that neighborhood.

Overall Cohesive Plan for the City

The City still needs to develop a vision of an overall cohesive plan for the City for the next 20 years. While OMW creates gathering spots within its project, the City needs to develop specific criteria and direction for that in all new projects. Downtown needs to be developed as a central gathering/entertainment area with true mixed-use housing that encourages people to visit businesses on foot or by bike. Walking needs to be safe and enjoyable everywhere and we need to continue improving bike lanes so that we can avoid automobile trips. The City needs a transit

O3-2

center or hub in Downtown and/or South Coast Metro. New housing should be true mixed-use that would encourage people to get out of their cars and visit businesses on foot or by bike. O3-2 cont'd

Summary

While we would like to see more affordable housing and open space in OMW and we are concerned about the cumulative impacts of additional traffic in this area (but believe mitigation efforts and implementation of the recommended improvements by the Developer will decrease OMW's portion of those cumulative impacts), OMW is a project that can be used as a model for other developments because it gives Costa Mesa what it is lacking: affordable housing, parkland and more active transportation facilities. We support Rose Equities' project, including the mitigation efforts contained in the Draft Environmental Impact Report, as it is currently proposed. O3-3

Thank you for your attention.

Very truly yours,

Richard Huffman

Richard Huffman

Cynthia McDonald

Cynthia McDonald

O3. RESPONSES TO COMMENTS FROM COSTA MESA FIRST, MARCH 23, 2020.

O3-1 The commenter discusses several topics in regard to the proposed project, including affordable housing; traffic impacts and required improvements; parkland; and noise, light, and air pollution.

The commenter encourages the applicant to provide additional affordable housing units beyond what is currently proposed to help meet the City's Regional Housing Needs Allocation and also encourages the City to adopt an inclusionary housing ordinance. Additionally, the commenter supports the proposed bicycle and pedestrian facilities, 1.5-acre open space area, and the required transportation improvements under Mitigation Measures T-1 and T-2. The commenter also acknowledges that noise, light, and air pollution from existing vehicular traffic along the I-405 Freeway on the proposed residences would be buffered by the proposed parking structure. Lastly, the commenter acknowledges that potential lighting impacts from the parking structure façade along the I-405 Freeway would be less than significant upon compliance with Specific Plan development standards, design guidelines, and Caltrans requirements. These comments are not related to the adequacy of the Draft EIR analysis and thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

O3-2 The commenter encourages the City to develop a cohesive plan for Costa Mesa for the next 20 years, including standards requiring public gathering places for new developments and revitalization of the City's downtown area as a mixed-use entertainment center. The commenter also supports more housing and mixed-use developments and multimodal improvements throughout the City. This comment is not related to the adequacy of the Draft EIR analysis and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

O3-3 Refer to response to comments O3-1 and O3-2. The commenter generally supports the proposed project; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Peggy Partnoff <peggypartnoff@yahoo.com>
Sent: Tuesday, February 18, 2020 9:08 AM
To: OMW Public Comments <OMWPublicComments@costamesaca.gov>
Subject: One Metro West Housing Project

As a home owner in Mesa Verde and resident of Costa Mesa I want to voice my opposition to the proposed One Metro West Apartment Project submitted by developer Rose Equities of Beverly Hills. The project is much too large in scope for the location and it's significant, unavoidable and problematic effects to the neighborhood, multiple communities and transportation infrastructure is absolutely unacceptable. P1-1

The Draft EIR determined there will be significant and unavoidable environmental impacts including transportation, noise, air quality, greenhouse gas emissions, and hydrology and water quality. Not to mention light pollution and it's intrusion into the single family homes in the State streets from it's 24 hour security and parking structure lighting illuminating from 7 stories. P1-2

Rose Equities has developed several similar high rise apartment developments in neighboring Irvine. The well documented complaints from neighbors, former tenants and current residents of these Rose Equities apartment developments highlight it's reputation for shoddy workmanship of the apartments, poor quality of the materials used, unfulfilled promises of project amenities, unsatisfactory property management and racial profiling in management practices, poor parking design, noise problems, and the lists go on. Nearby neighbors of the projects have been unduly saddled with parking problems, noise, tenant nuisances and poor management of the property tenants. Meanwhile, Rose Equities is long gone.. profits made and neighborhoods changed forever. Explotive profits & politician's ambitions gratified.. all at the expense of the citizens of Costa Mesa. If the City of Irvine could not guarantee their citizens a quality controlled project with Rose Equities why would Costa Mesa believe they would have a different outcome? P1-3
This is not the right project for the property identified. Rose Equities Development has been given a "pass" to our precious community assets, in exchange for some financial donations to the Bridge Shelter. And who knows what else? I oppose the One Metro West Project as proposed and request the Costa Mesa City Council members to demand a scaled down version that might mitigate the hardships to our communities current and future citizens.

Respectfully,
Margaret Partnoff
3321 Alabama Circle
Costa Mesa

P1. RESPONSES TO COMMENTS FROM MARGARET PARTNOFF, FEBRUARY 18, 2020.

P1-1 The commenter generally opposes the project and states that the project is too large in scope and would result in unacceptable environmental impacts to the neighborhood, multiple communities, and transportation infrastructure facilities. This comment broadly states the project would result in unacceptable environmental impacts however does not identify a specific concern with the adequacy of the Draft EIR or raise an issue or comment specifically related to the Draft EIR's environmental analysis. Therefore, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P1-2 The commenter lists the significant and unavoidable impacts related to the proposed project, including transportation, air quality, and greenhouse gas emissions. However, the commenter incorrectly identifies significant and unavoidable impacts related to hydrology and water quality and noise. As detailed in Section 5.8, *Hydrology and Water Quality*, and Section 5.10, *Noise*, of the Draft EIR, impacts related to hydrology and water quality and noise would be less than significant upon implementation of regulatory requirements and standard conditions of approval and would not require any mitigation measures.

The commenter also raises concerns regarding the project's potential light pollution into single-family residences in the "State streets," located greater than 200 feet to the south of the project site across the Interstate 405 (I-405) Freeway, particularly from the project's proposed 24-hour security and parking structure lighting. As analyzed in Draft EIR Section 5.1, *Aesthetics*, the most visible source of lighting of the project site from the residences south of the I-405 Freeway would emanate from exterior lighting on Building A and interior parking structure lighting along the southern edge of the site. Parking structure lighting would be designed to minimize light spillover and installed to concentrate light on pedestrian and vehicle aisles and ramps with spillover lighting adequate to illuminate parking stalls (refer to PPP AES-2). Further, in order to reduce impacts related to light and glare from the parking façade, the *One Metro West Specific Plan* (Specific Plan) includes development standards which specify project lighting requirements to ensure exterior lighting is shielded and directed downward, or otherwise directed away from off-site properties. The development standards also stipulate that project lighting adjacent to the I-405 Freeway would be required to meet applicable Caltrans standards. An Exterior Lighting Plan would be required, prior to issuance of the first building permit, that identifies and depicts locations, design, types, scale, and illumination power of lighting fixtures, including on all building exteriors and within the open space/trail connection areas. SCA AE-5 would require preparation of a Lighting Plan and Photometric Study for review and approval by the City's Development Services Director. The Lighting Plan and Photometric Study would include performance standards to minimize the project's potential lighting impacts. Mitigation Measure AE-1 would ensure the Lighting Plan and Photometric Study demonstrate compliance with several additional lighting performance measures in order to demonstrate that the project's lighting meets minimum security lighting requirements and minimizes lighting impacts to surrounding uses. With implementation of applicable PPPs, SCAs, and mitigation measures, operational lighting impacts associated with the project would result in less than significant impacts. It should also be noted that the project area includes substantial existing sources of artificial lighting that are typical for an urbanized area, including interior lighting, landscaping lighting, parking lot lighting, security lighting, signage, vehicular lighting, and street lighting, especially along the I-405 Freeway.

Additionally, the proposed 24-hour security on-site is related to security cameras and security patrols per SCA PD-58. As detailed, cameras are proposed to be installed in all common areas and hallways, and would be monitored 24 hours per day, seven days a week, at a centralized location by the applicant's property management team. Further, in the afternoon and through the night, a third-party courtesy patrol would patrol and walk the property. Thus, the proposed 24-hour security would not result in lighting impacts.

P1-3 The commenter raises general opposition to the proposed project and the applicant, Rose Equities. The commenter also states that other Rose Equities developments in Orange County, particularly high-rise apartment buildings, were constructed with shoddy workmanship/quality and have noise problems, poor parking designs, and unsatisfactory property management, among other alleged problems. This comment does not identify a specific concern with the adequacy of the Draft EIR or raise an issue or comment specifically related to the Draft EIR analysis. Therefore, no further response is warranted as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P2

From: Dennis Ashendorf <outlook_514457AC4BFC670E@outlook.com> **On Behalf Of** Dennis Ashendorf
Sent: Wednesday, February 26, 2020 10:58 PM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: Letter in Support for the Proposed Metro One West Housing Project - Dennis Ashendorf

Ms. Minoo Ashabi
Principal Planner
City of Costa Mesa

Dear Ms. Ashabi,

Attractive, modern homes with exceptional integrated landscaping and transportation benefit not only the City of Costa Mesa but also provide young families stakes in our city's future. A city with a broad base of ages, occupations, and backgrounds stabilizes dynamically. One Metro West will help all of us for many decades.

The developments and businesses north of the 405 such as SoCo, The Press, Vans, and the Hive secure a future base for Costa Mesa. They create high paying jobs that support our businesses, schools, and public life; especially if the creative people working here, live here.

The first counter-intuitive irony of development is that the more people that live and work in our city, the less traffic we will face. Consider new development not just in Costa Mesa, but around us. If we don't allow more housing, people will be driving back and forth, end-to-end, through our city, but if people live and work here, the resulting NEW traffic will be more localized. Of course, most new residents may not work in Costa Mesa, but NEW traffic would still be less than NEW traffic without any local new homes. P2-1

Many people argue against all new development. As someone who has lived in a declining area of great beauty, wealth, and sophistication before, I know far better than most that home prices can decline greatly. Most homes in Costa Mesa are small single stories with prices near one million dollars. These prices will drop if new creative businesses DON'T locate here. The second counter-intuitive irony of homes not sitting on a beach is that if more homes are NOT built, current homes will at first increase in value, then crash. High prices, need high incomes to purchase, but companies cannot locate here if there aren't homes for new workers. Catch-22 isn't just a title of a book, but a set of real concerns that cannot be wisely ignored.

We need One Metro West; which also strives to be self-contained to minimize its impact on areas south of the 405. We will all be richer as a result, or poorer otherwise.

Sincerely yours,

Dennis Ashendorf

3210 Montana Avenue
Costa Mesa, CA 92626

P2. RESPONSES TO COMMENTS FROM DENNIS ASHENDORF, FEBRUARY 26, 2020.

P2-1 The commenter generally supports the proposed project, bringing new homes closer to employment opportunities, and new development in Costa Mesa that can bolster the local economy. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

February 24, 2020

Mayor Katrina Foley & Costa Mesa City Council

RE: Support for the One Metro West Community

Dear Major Foley and Councilmembers:

As a resident of Costa Mesa since 2014, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.

The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day. I believe, the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.

It will also create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing their community to keep residents in the neighborhood for dining, shopping, and work, unnecessary traffic and disruption in our neighborhoods will be avoided while at the same time funds paid by the community can be used to improve parks and amenities in traditional neighborhoods like the one I call home. P3-1

Costa Mesa has grown as a city and a community by being at the forefront of planning great neighborhoods, parks, retail, and we are proud to be a part of that shared success story and look forward to One Metro West being part of that story as well.

Sincerely,

Arturo Manas
143 Tribeca Way
Costa Mesa, CA 92627

P3. RESPONSES TO COMMENTS FROM ARTURO MANAS, FEBRUARY 24, 2020.

P3-1 The commenter generally supports the proposed project and new development that can bolster the local economy and introduce more housing in Costa Mesa. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P4

February 28, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for One Metro West

Dear Mrs. Ashabi

As the owners of the Cheese Shop at OC Mix at South Coast Collection (SOCO), we support the One Metro West community proposed next door to SOCO.

SOCO is home to more than 70 curated restaurants, showrooms and stores, and has become one of the culinary and cultural jewels of Costa Mesa and Orange County. Many of Southern California's top chefs call SOCO and The OC Mix home.

SOCO is a gathering place, drawing foodies and design fans from throughout Costa Mesa and Southern California to our creative enclave north of the 405. With thousands of new jobs coming to our neighborhood, we believe One Metro West will provide a much-needed addition of housing for the creatives and professionals who are some of our most important customers. P4-1

Our businesses will benefit greatly from having new residents next door to SOCO, an easy walk away. The neighborhood will benefit from the proposed new park at One Metro West, easier access to the Santa Ana River Trail, and improved bikeways and sidewalks making walking and cycling more attractive.

Costa Mesa has grown as a city and a community, and we are proud to be a part of that shared success story. We look forward to One Metro West being a part of that story as well.

Sincerely,

Naveed
The Cheese Shop
South Coast Collection

P4. RESPONSES TO COMMENTS FROM NAVEED ANWAR, FEBRUARY 28, 2020.

P4-1 The commenter generally supports the proposed project and new development in the vicinity of the South Coast Collection (SOCO) that introduces more housing, open space, and multimodal improvements to the area. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Michael Gregg <MGregg@shopoff.com>
Sent: Friday, February 28, 2020 11:36 AM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: OMW Letter of Support

Dear Mrs. Ashabi,

As a resident of Costa Mesa since 2010, I am writing you in support the proposed One Metro West community.

The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.

It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods. P5-1

A strong housing policy should be a part of our civic north star. This includes all kind of housing, for-sale and for-rent (both market and affordable). Housing is at the core of so many of society's issues (transit, global warming, inequity, segregation, economic growth, generational wealth gaps, etc). Having a healthy housing market which reacts appropriately to all this issues is fundamental to the solutions for same.

As Costa Mesa looks to the future, ideas like One Metro West are roundly supported by economists and environmentalist alike. For these reasons, I am supportive this plan and community.

Sincerely,

Michael Gregg
297 23rd Street
Costa Mesa, Ca 92627

P5. RESPONSES TO COMMENTS FROM MICHAEL GREGG, FEBRUARY 28, 2020.

P5-1 The commenter generally supports the proposed project and new development that can bolster the local economy and introduce more housing in Costa Mesa. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

STEELWAVE

Dear Mayor Foley, Mayor Pro Tem Stephens, Council Member Chavez, Council Member Genis, Council Member Mansoor, Council Member Marr, Council Member Reynolds, and Costa Mesa City Staff

Re: Letter in Support of One Metro West's Environmental Impact Report

SteelWave would like to submit this letter in support of One Metro West, the mixed-use community proposed by Rose Equities to replace the current Sakura Paper manufacturing plant at 1683 Sunflower Ave.

As you know, SteelWave is a full-service commercial, multifamily and mixed-use real estate management, operating company and investment management firm with an office located in Costa Mesa, CA. We have been active in commercial and multi-family real estate for over 46 years and have built a reputation for successful execution throughout our target markets. Specifically, we have two significant creative office and mixed use properties in Costa Mesa: HIVE and The Press.

HIVE is our 182,000-square-foot creative office campus located at 3333 S. Susan St. We acquired this project in 2015 and repositioned the three buildings to a multitenant creative office project, leasing up the project to near full occupancy which includes the Los Angeles Chargers headquarters and training facility.

The Press, located at 1375 Sunflower and 1376 South Coast Dr., is the former Los Angeles Times printing press warehouse, newsroom, and office building. We are starting construction on this project in Q4 2019 and when complete, Phase I will over 380,000 square feet of top of the market creative office space and a 51,000 square feet retail market hall. The market hall will be comprised of curated multi-tenant food, retail and entertainment that feature local makers, crafters, artisan and restaurant tenants that create a vibrant and engaging campus while offering the community with this unique retail amenity. P6-1

As proven by our projects, SteelWave creates exceptional environments, forges strong relationships and creates enduring value. We believe that One Metro West will be a great addition to our community and would be a nice complement to our HIVE and Press projects.

With SOCO, the new Vans headquarters, the Los Angeles Chargers, the Press and Hive, we believe this pocket of Costa Mesa just north of the 405 has already begun to transform and draw top office tenants and visitors. We believe the One Metro West project will contribute to the transformation of the area with the addition of new residential units. And residents will help activate the area throughout the day and evening which will further transform the area into a true work, live, play submarket.

3335 Susan Street, Suite 125, Costa Mesa CA 92626 | PH 949-863-0390 | WEB SteelWaveLLC.com

STEELWAVE

In review of the EIR, we see that all the benefits of providing homes near jobs have been confirmed. Once completed, the PRESS and the Hive will generate thousands of jobs to Costa Mesa. Having nearby, pedestrian-friendly homes signifcantly reduces impacts on our environment when faced the alternative of having no new homes north of the 405.

We hope the City Council will continue to have the opportunity to review the merits of One Metro West in the near-term. The current and future tenants of the Press and the HIVE will unquestionably benefit from these types of live-work-play environs, which is why we support One Metro West.

Please feel free to contact the undersigned with any questions or comments.

P6-1 cont'd

Sincerely,

S. H

Seth Hiromura
SteelWave, LLC
Managing Director, Acquisitions & Development

P6. RESPONSES TO COMMENTS FROM SETH HIROMURA, FEBRUARY 28, 2020.

P6-1 The commenter generally supports the proposed project and new live-work developments that can bolster the local economy and introduce more housing in Costa Mesa. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Mike Mullen <mmullen@surterreproperties.com>
Sent: Thursday, March 05, 2020 2:33 PM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: One Metro West

Dear Minoo,

I would like to offer my support for the One Metro West project that is under consideration for Costa Mesa. I feel that the project is well thought out and would be a great asset to the community especially in light of the new Press project. The proposed development is in an area that probably would otherwise be underutilized. The other great advantage is this project will help greatly with the incredibly overzealous state housing requirements that have recently come down from Sacramento. P7-1

All in all this is a good addition to our city and I hope it is well received by the planning commission.

Regards
Mike Mullen
1120 Dana Dr.
Costa Mesa
Mike Mullen

949.285.6906
www.SurterreProperties.com
DRE#01311226

1400 Newport Center Drive • Suite 100 • Newport Beach, CA 92660•DRE#01778230

P7. RESPONSES TO COMMENTS FROM MIKE MULLEN, MARCH 5, 2020.

P7-1 The commenter generally supports the proposed project, including new trail connections and pedestrian improvements, revitalization of the currently underutilized site, and introduction of more housing in Costa Mesa. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P8

March 9, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for the One Metro West

Dear Minoo:

As a Millennial resident of Costa Mesa, I wanted to discuss my support for the proposed One Metro West community.

There is an incredible demand for my generation for places to live near jobs and amenities. More importantly, places to live near upwardly mobile jobs which are so important to all of our futures. These are the types of jobs are prevalent in Costa Mesa's economic engine, north of the 405.

One Metro West is the ideal complement to these jobs, not only because they are bringing much needed housing, but because they are paying so much attention to the pedestrian. The walkable connection from the Santa Ana River Trail to One Metro West, SOCO, VANS and beyond are the needed building blocks for an area of Costa Mesa which has so much promise for the city's future. P8-1

Costa Mesa has grown as a city and a community by being at the forefront of planning great neighborhoods, parks and retail. One Metro West is the continuation of this tradition and is a great piece of Costa Mesa's future, which should be focused north of the 405.

Sincerely,

Daniel Tyner
155 Flower #A
Costa Mesa, CA 92627

P8. RESPONSES TO COMMENTS FROM DANIEL TYNER, MARCH 9, 2020.

P8-1 The commenter generally supports the proposed project and new development north of the I-405 Freeway that can bolster the local economy and introduce more housing in Costa Mesa. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

March 9, 2020

Minoo Ashabi
Planner
City of Costa Mesa

RE: Support for One Metro West

Dear Mrs. Ashabi:

I am the Design Director at Kaz Design Group. We operate the Linge Roset and Scavolini store in South Coast Collection (SOCO) and I wanted to express our support the One Metro West community proposed next door to SOCO.

One of the Kaz Design Group's several brands is Linge Roset, Scavolini and SOCO has been a wonderful home for us. SOCO is a gathering place, drawing foodies and design fans from throughout Costa Mesa and Southern California to our creative enclave north of the 405. There is an intimacy of design which our customers are drawn to and what we love about the One Metro West project are the similar feelings it will bring to our greater neighborhood. P9-1

SOCO and all our neighbors will benefit greatly from having new residents next door, an easy walk away. Meanwhile, the new park at One Metro West, the easier access to the Santa Ana River Trail, and the improved bikeways and sidewalks will provide a much needed sense of connectivity to the area.

Costa Mesa has grown as a city and a community, and we are proud to be a part of that shared success story. We look forward to One Metro West being a part of that story as well.

Sincerely,

Mase Kazerani
Showroom Director
Kaz Design Group
Linge Roset & Scavolini

P9. RESPONSES TO COMMENTS FROM MASE KAZERANI, MARCH 9, 2020.

P9-1 The commenter generally supports the proposed project, particularly the introduction of new residences, open space, and multimodal improvements in the vicinity of SOCO. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Flo Martin <flomama@aol.com>
Sent: Tuesday, March 10, 2020 10:59 AM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: EIR One Metro West

Chapter 5, EIR for One Metro West, speaks volumes in support of the project.

5.2-26: The project is consistent with Costa Mesa General Plan and Policies.
5.1.7: Mitigation Measures are significant.
5.3.8: No archaeological resources were identified in the records search. Impact would be reduced to less than significant levels.
5.4.6: Energy: the project would utilize electricity provided by SCE. No mitigation measures are required. P10-1
5.5.8: Geology and Soil: Less than significant impact with mitigation incorporated.
5.6-3: Green House Gas Emissions: level of significance, even after mitigation is "significant and unavoidable."
5.7-2: the project would be constructed and operated with strict adherence to all emergency response requirements.

5.8-6: Hydrology and water quality: No mitigation measures required. Impacts would be less than significant.
5.9-2: The project would be consistent with the …General Plan policies and …with the General Plan Land Use Map and zoning Maps.
5.10-7, 8: Noise…no mitigation measures required. Impacts would be less than significant.
5.11-2: The project's population and employment growth would be offset by the …increase in housing units, a portion of which would include affordable housing to help meet the City's 6th cycle RHNA allocations.
5.12-5: detailed description of positive impact for Park Facilities and Recreation Services.
5.13: The detailed charts of transportation level of service boggles the mind! The City definitely needs to focus on increasing ACT infrastructure. OCTA definitely needs to focus on providing more efficient public transportation. (cf. Impact 5.13-4)
The project is consistent with the City's goals of promoting active transportation systems. P10-1 cont'd
5.14.7: Mitigation Measures for Impact 5.14-1assure that Native American monitors will oversee project grading activities involving native soils.
5.15-10: Project implementation would not result in increased demands that require or result in increased demands to dry utilities.

The significant and unavoidable adverse impacts are few:
1. Air quality during construction only
2. Greenhouse gas emissions
3. Traffic at South Coast/Susan will experience a negative impact. Hopefully, the City will update this intersection in the near future.

Since folks working at the PRESS will have to live somewhere, projects like One Metro West will offer them an alternative that can't be beat. From what I understand, the actual residential vehicle miles traveled for this project shows an 18% reduction. This reduction amounts to some serious (!!) miles off the road annually.

As a 53-year Costa Mesa resident who supports climate change measures, I support the One Metro West project for our city.

Flo Martin
2442 Andover Place
Costa Mesa, CA 92626
949.933.3699

Flo
"It is when we are alone that we are the least alone." St. Augustine

P10. RESPONSES TO COMMENTS FROM FLO MARTIN, MARCH 10, 2020.

P10-1 The commenter generally supports the proposed project and cites portions of the Draft EIR that support her sentiment. This comment does not identify a specific concern with the adequacy of the Draft EIR or raise an issue or comment specifically related to the Draft EIR analysis. Therefore, no further response is warranted as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

MARK R. SCHEURER
1523 Orange Ave.
Costa Mesa, Calif. 92627

February 25, 2020

Minoo Ahsabi, Principal Planner
City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

RE: One Metro West EIR, Specific Plan, and Master Plan

Dear Minoo Ashabi:

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P11-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Mark Scheurer

P11. RESPONSES TO COMMENTS FROM MARK SCHEURER, FEBRUARY 25, 2020.

P11-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements within Costa Mesa. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

March 12, 2020

Minoo Ashabi
Planner
City of Costa Mesa

RE: Support for One Metro West

Dear Mrs. Ashabi:

I am the Owner at BoConcept in South Coast Collection (SOCO) and we wanted to express our support the One Metro West community proposed next door to SOCO.

SOCO is a gathering place, drawing foodies and design fans from throughout Costa Mesa and Southern California to our creative enclave north of the 405. It's been a wonderful home for us. There is an intimacy of design which our customers are drawn to and what we love about the One Metro West project are the similar feelings it will bring to our greater neighborhood. P12-1

SOCO and all our neighbors will benefit greatly from having new residents next door, an easy walk away. Meanwhile, the new park at One Metro West, the easier access to the Santa Ana River Trail, and the improved bikeways and sidewalks will provide a much needed sense of connectivity to the area.

Costa Mesa has grown as a city and a community, and we are proud to be a part of that shared success story. We look forward to One Metro West being a part of that story as well.

Sincerely,

Stéphane DUVAL
BoConcept
Owner

P12. RESPONSES TO COMMENTS FROM STÉPHANE DUVAL, MARCH 12, 2020.

P12-1 The commenter generally supports the proposed project and new development in the vicinity of SOCO that introduces more housing, open space, and multimodal improvements. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P13

From: Nicole Brunner <nicole@nestbedding.com>
Sent: Thursday, March 12, 2020 1:25 PM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: One Metro West

Minoo Ashabi
Planner
City of Costa Mesa

RE: Support for One Metro West

Dear Mrs. Ashabi:

I am the Manager at Nest Bedding in South Coast Collection (SOCO) and we wanted to express our support the One Metro West community proposed next door to SOCO.

SOCO is a gathering place, drawing foodies and design fans from throughout Costa Mesa and Southern California to our creative enclave north of the 405. It's been a wonderful home for us. There is an intimacy of design which our customers are drawn to and what we love about the One Metro West project are the similar feelings it will bring to our greater neighborhood.

SOCO and all our neighbors will benefit greatly from having new residents next door, an easy walk away. Meanwhile, the new park at One Metro West, the easier access to the Santa Ana River Trail, and the improved bikeways and sidewalks will provide a much needed sense of connectivity to the area. P13-1

Costa Mesa has grown as a city and a community, and we are proud to be a part of that shared success story. We look forward to One Metro West being a part of that story as well.

Sincerely,

Nicole Brunner
Nest Bedding

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Respectfully,

Nicole Brunner
Showroom Manager

Nest Bedding at The SOCO Design Center Suites
3323 Hyland Ave. Suite D
Costa Mesa, CA 92626

www.nestbedding.com
(714) 740-7314

www.NestBedding.com

www.NestBedding.com

P13. RESPONSES TO COMMENTS FROM NICOLE BRUNNER, MARCH 12, 2020.

P13-1 The commenter generally supports the proposed project and new development in the vicinity of SOCO that introduces more housing, open space, and multimodal improvements. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P14

From: K. Misa Sullivan <kmisa18@gmail.com>
Sent: Thursday, March 12, 2020 3:42 PM
To: ASHABI, MINOO
Subject: Support for One Metro West

Dear Mrs. Ashabi:

As a resident of Costa Mesa since 2018, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.

The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.

It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods. P14-1

There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa.

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

Sincerely,

Misa Sullivan
955 W. 19th Street
Unit E228
Costa Mesa, CA 92627

P14. RESPONSES TO COMMENTS FROM MISA SULLIVAN, MARCH 12, 2020.

P14-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, open space, and multimodal improvements north of the I-405 Freeway. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

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From: Meredith Oliver <meredith@cwsdefense.com>
Sent: Thursday, March 12, 2020 4:29 PM
To: ASHABI, MINOO
Subject: Support for One Metro West

Dear Mrs. Ashabi:
As a resident of Costa Mesa since 2014, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.
The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.
It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.
There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa. P15-1

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

Sincerely,

Meredith Oliver
2048 Garden Lane, Unit B
Costa Mesa, CA 92627

P15. RESPONSES TO COMMENTS FROM MEREDITH OLIVER, MARCH 12, 2020.

P15-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, open space, and multimodal improvements north of the I-405 Freeway. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P16

From: Alexa Dordoni <alexadordoni@gmail.com>
Sent: Thursday, March 12, 2020 4:31 PM
To: ASHABI, MINOO
Subject: Support for One Metro West

Dear Mrs. Ashabi:
As a resident of Costa Mesa since 2000, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.
The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.
It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.
There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa.

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

P16-1

Sincerely,

Alexa Dordoni
1018 American Place, Costa Mesa, California 92627

P16. RESPONSES TO COMMENTS FROM ALEXA DORDONI, MARCH 12, 2020.

P16-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, open space, and multimodal improvements north of the I-405 Freeway. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Robertson, Chris <Chris.Robertson@lfg.com>
Sent: Friday, March 13, 2020 2:25 PM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: One Metro West

Dear Mrs. Ashabi:

As a resident of Costa Mesa since 2018, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.

The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.

It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods. P17-1
There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa.

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

Sincerely,

Chris Robertson

133 Cecil Place, Costa Mesa CA

Comprehensive Wealth Planner, CA License #4011278
Associated with Peter Robertson, ChFC
Member of the Resource Group
CA License #0727157
Sagemark Consulting | Lincoln Financial Advisors Corp.
18400 Von Karman Ave., Suite 400, Irvine, CA 92612
p (949) 474-6838 | *f* (949) 757-2624 | *e* Chris.Robertson@lfg.com

and may be unlawful. If you have received this E-mail in error, please notify the sender immediately and permanently delete the original and any copy of this E-mail and any printout. Thank You.**

P17. RESPONSES TO COMMENTS FROM CHRIS ROBERTSON, MARCH 13, 2020.

P17-1 The commenter generally supports the proposed project, including the introduction of more housing, jobs, open space, and multimodal improvements north of the I-405 Freeway. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

TRELLIS
We're Better Together

March 17, 2020

Dear Minoo Ashabi -

For several years now, I have watched the One Metro West community proposal develop. I have been impressed by their level of involvement and commitment to the community and that their approach will add much needed housing for all types of Costa Mesa residents and those that work here while not changing the traditional neighborhoods many of our residents call home south of the 405 or near South Coast Metro.

In addition, by adding a new 1.5 acre open space on what is now a decades old industrial site, every member of the public can start to see how our community is better together which is one of the goals at Trellis that Rose Equities and the One Metro West community have worked to help make a reality. P18-1

Costa Mesa has an established, recognized need for housing and the approved and under development projects north of the 405 show that the need for housing will continue to grow. By approving One Metro West, Costa Mesa will be providing a realistic and positive solution for many residents, employers, and new employees looking for housing that does not require long work commutes or drives for shopping, restaurants, and entertainment.

We look forward to continuing to support One Metro West in the future and appreciate your consideration of our thoughts.

Sincerely,

Ian Stevenson
Executive Director
TRELLIS / (949) 422-5331
wearetrellis.com

P18. RESPONSES TO COMMENTS FROM IAN STEVENSON, MARCH 17, 2020.

P18-1 The commenter generally supports the proposed project, particularly the revitalization of the underutilized industrial site and introduction of more housing, jobs, and open space within Costa Mesa, while not impacting residences south of the I-405 Freeway or near South Coast Metro. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P19

March 18, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for the One Metro West

Dear Minoo:

As a Millennial resident of Costa Mesa, I wanted to discuss my support for the proposed One Metro West community.

There is an incredible demand for my generation for places to live near jobs and amenities. More importantly, places to live near upwardly mobile jobs which are so important to all of our futures. These are the types of jobs are prevalent in Costa Mesa's economic engine, north of the 405.

One Metro West is the ideal complement to these jobs, not only because they are bringing much needed housing, but because they are paying so much attention to the pedestrian. The walkable connection from the Santa Ana River Trail to One Metro West, SOCO, VANS and beyond are the needed building blocks for an area of Costa Mesa which has so much promise for the city's future. P19-1

Costa Mesa has grown as a city and a community by being at the forefront of planning great neighborhoods, parks and retail. One Metro West is the continuation of this tradition and is a great piece of Costa Mesa's future, which should be focused north of the 405.

Sincerely,

Kellan Liem
1035 Sea Breeze Dr
Costa Mesa, CA 92626

P19. RESPONSES TO COMMENTS FROM KELLAN LIEM, MARCH 18, 2020.

P19-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, open space, and multimodal improvements north of the I-405 Freeway. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P20

Project Independence
Enriching Lives. Expanding Choices.

March 18, 2020

Dear Minoo Ashabi -

I have happily followed the One Metro West community proposal develop. I have been impressed by their level of involvement and commitment to the community and that their approach will add much needed housing for all types of Costa Mesa residents and those that work here, while not changing the traditional neighborhoods many of our residents call home south of the 405 or near South Coast Metro. I am in the enviable position of being a Mesa Verde North resident and work at Cambridge Park, adjacent to the proposed project. I am thrilled we have a dynamic developer with a creative strategy for our community. Costa Mesa needs this and so does our neighborhood.

In addition, by adding a new 1.5 acre open space on what is now a decades old industrial site, every member of the public can start to see how our community is better together which is one of the goals at Project Independence that Rose Equities and the One Metro West community have worked to help make a reality. P20-1

Costa Mesa has an established, recognized need for housing and the approved and under development projects north of the 405 show that the need for housing will continue to grow. By approving One Metro West, Costa Mesa will be providing a realistic and positive solution for many residents, employers, and new employees looking for housing that does not require long work commutes or drives for shopping, restaurants, and entertainment.

We look forward to continuing to support One Metro West in the future and appreciate your consideration of our thoughts.

Sincerely,

Debra Marsteller

3374 California St. AND

3505 Cadillac, O103

Costa Mesa, CA 92626

P20. RESPONSES TO COMMENTS FROM DEBRA MARSTELLER, MARCH 18, 2020.

P20-1 The commenter generally supports the proposed project, particularly the revitalization of the underutilized industrial site and introduction of more housing, jobs, and open space within Costa Mesa while not impacting residences south of the I-405 Freeway or near South Coast Metro. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: webmaster@costamesaca.gov <webmaster@costamesaca.gov> on behalf of City of Costa Mesa <webmaster@costamesaca.gov>
Sent: Thursday, March 19, 2020 8:55 AM
To: ASHABI, MINOO
Subject: Support for the One Metro West

Message submitted from the <City of Costa Mesa> website.

Site Visitor Name: Carter Jones
Site Visitor Email: carter.jones5@yahoo.com

March 19, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for the One Metro West

Dear Minoo:

As a Millennial resident of Costa Mesa, I wanted to discuss my support for the proposed One Metro West community.

P21-1

There is an incredible demand for my generation for places to live near jobs and amenities. More importantly, places to live near upwardly mobile jobs which are so important to all of our futures. These are the types of jobs are prevalent in Costa Mesa's economic engine, north of the 405.

One Metro West is the ideal complement to these jobs, not only because they are bringing much needed housing, but because they are paying so much attention to the pedestrian. The walkable connection from the Santa Ana River Trail to One Metro West, SOCO, VANS and beyond are the needed building blocks for an area of Costa Mesa which has so much promise for the city's future. P21-1 cont'd

Costa Mesa has grown as a city and a community by being at the forefront of planning great neighborhoods, parks and retail. One Metro West is the continuation of this tradition and is a great piece of Costa Mesa's future, which should be focused north of the 405.

Sincerely,

Carter Jones
2775 Mesa Verde Drive East APT M213
Costa Mesa, CA 92626

P21. RESPONSES TO COMMENTS FROM CARTER JONES, MARCH 19, 2020.

P21-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, open space, and multimodal improvements north of the I-405 Freeway. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P22

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Aaron Ludwig – 983 Hartford Way, Costa Mesa, CA 92626

Date: March 20, 2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P22-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Aaron Ludwig
983 Hartford Way
Costa Mesa, CA 92626
949-777-6699
aludwig@gmail.com

P22. RESPONSES TO COMMENTS FROM AARON LUDWIG, MARCH 20, 2020.

P22-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to existing employment and residential developments. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P23

DONALD L. MORROW
28 ROYAL SAINT GEORGE ROAD
NEWPORT BEACH, CA 92660

March 20, 2020

Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

Re: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

I have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our community. While I live in Newport Beach, I visit Costa Mesa frequently. We need more housing in Costa Mesa and its adjoining cities to house the employees of the companies already operating in the City, let alone the companies moving to Costa Mesa. P23-1

Building new residential projects nearby our employment centers will reduce long commutes on freeways and improve traffic. This is the type of project that makes sense for Costa Mesa and Orange County. I urge the Planning Department and the City Council to approve this project.

Yours very truly,

Donald L Morrow

Donald L. Morrow

P23. RESPONSES TO COMMENTS FROM DONALD MORROW, MARCH 20, 2020.

P23-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to existing employment and residential developments. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P24

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Leigh White, Costa Mesa resident
575 West 19th St., Costa Mesa, CA 92627

Date: 03-20-2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P24-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Leigh White
575 West 19th St., Costa Mesa, CA 92627

P24. RESPONSES TO COMMENTS FROM LEIGH WHITE, MARCH 20, 2020.

P24-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to existing employment and residential developments. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P25

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Michael Gonzaguirre
2775 Mesa Verde Dr E, Apt Y208
Costa Mesa, CA 92626

Date: 20 March 2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P25-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Michael Gonzaguirre
714-754-4500
mgonzaguirre@urbanarena.com
2775 Mesa Verde Dr E, Apt Y208
Costa Mesa, CA 92626

P25. RESPONSES TO COMMENTS FROM MICHAEL GONZAGUIRRE, MARCH 20, 2020.

P25-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to existing employment and residential developments. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Neal Burns

Date: Friday, March 20, 2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P26-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Neal Burns
313 Wake Forest Rd.
Costa Mesa, Ca 92626
(949) 351-5750
nealwburns@yahoo.com

P26. RESPONSES TO COMMENTS FROM NEAL BURNS, MARCH 20, 2020.

P26-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to existing employment and residential developments. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P27

From: russell rowlands <mvpolo@hotmail.com>
Sent: Saturday, March 21, 2020 8:07 PM
To: ASHABI, MINOO
Subject: One Metro West

Dear Mrs. Ashabi:
As a resident of Costa Mesa since 2015, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.
The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.
It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.
There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa. P27-1

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

Sincerely,

Linda Rowlands
221 Del Mar Ave. #C
Costa Mesa, Ca. 92627

P27. RESPONSES TO COMMENTS FROM LINDA ROWLANDS, MARCH 21, 2020.

P27-1 The commenter generally supports the proposed project, including the introduction of housing north of the I-405 Freeway and development of residential, employment, and retail within one neighborhood. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Russell Rowlands <russellrowlands4@gmail.com>
Sent: Saturday, March 21, 2020 8:01 PM
To: ASHABI, MINOO
Subject: One Metro West

Dear Mrs. Ashabi:
As a resident of Costa Mesa since 2012, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.
The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.
It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.
There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa. P28-1

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

Sincerely,

Russell Rowlands
2476 Elden Ave #B
Costa Mesa, Ca. 92627

P28. RESPONSES TO COMMENTS FROM RUSSELL ROWLANDS, MARCH 21, 2020.

P28-1 The commenter generally supports the proposed project, including the introduction of housing north of the I-405 Freeway and development of residential, employment, and retail within one neighborhood. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Lance Huante

1187 Gleneagles Terrace, Costa Mesa, CA 92627

Date: 3-21-2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P29-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Lance Huante

1187 Gleneagles Terrace, Costa Mesa, CA 92627

714-321-3777

lancehuante@gmail.com

P29. RESPONSES TO COMMENTS FROM LANCE HUANTE, MARCH 21, 2020.

P29-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to employment and residential developments. The comment is acknowledged. As the comment is not related to the adequacy of the Draft EIR analysis, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P30

May 22, 2020

RE: Support for the One Metro West Project

To Whom It May Concern:

As I understand the challenging times for Costa Mesa, please let me outline briefly 2 drivers in support of Metro West.

1) We are experiencing revenue shortfalls threw brick & mortar retail outlets because of Internet impacts. This pressure curve can be reasonably seen as increasing over time.

2) We also have pressures from state leadership to expand housing demands.

These 2 pressures alone will require movement forward, either by leadership locally or leadership from external forces. I prefer to see our council act collaboratively now, rather than under additional state's pressure and threat of fines/penalties. Bad decisions tend to be made under threat of penalty just as we have seen with the council's mismanagement of the homeless shelter 2-pronged approached. As a reminder the $6 million homeless shelter was not completed in the first quarter of 2020 as promised to the community and still sits vacant to date. P30-1

One Metro West provides the city with the opportunity to drive the necessary slow growth, and address local housing needs, including affordable housing. I just ask that the city be transparent now, about the costs to taxpayers and actual traffic issues. The voters need TRANSPARENCY regarding the overall traffic mitigation and financial plan.

Costa Mesa should be growing forward, not catching up.

Sincerely,

Frederik T. Solter

703 Center Street

P30. RESPONSES TO COMMENTS FROM FREDERIK SOLTER, MARCH 22, 2020.

P30-1 The commenter raises general concerns regarding the State-mandated expansion of housing in Costa Mesa and decrease in City revenue from the replacement of brick and mortar retail outlets with e-commerce. The commenter supports the project's introduction of housing, including affordable housing, into the City to help meet the local housing needs. The commenter also requests the City to be transparent regarding the costs to taxpayers and traffic issues associated with the proposed project. Transportation and traffic impacts associated with the proposed project are fully analyzed in Section 5.13, *Transportation*, of the Draft EIR. These comments are not related to the adequacy of the Draft EIR analysis; as such, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P31

May 22, 2020

Attention: Costa Mesa City Council & City Hall Staff
Regarding: One Metro West Proposal North of the 405 Fwy.

Dear City Council & Staff,

One Metro West (OMW) is being presented at a time where our city is facing uncertainty in the marketplace due to the COVID-19 outbreak, and the economic impacts from over regulation. The impacts of over regulation makes adding to the housing supply challenging and costly. While the city is under pressure to meet the Regional Housing Needs Assessment mandates and increase the private housing supply, **I hope you do not rush this process**. Rushed decision making can equate to financial consequences, like mass vacancies and additional municipal expenditures for which we cannot sustain. P31-1

As a Realtor and property investor, I reached out to various neutral industry experts within my network. What I have learned is that this EIR and Traffic Appendix are vague in terms of how to meet the goal of reducing traffic. This isn't just a theoretical exercise – we're talking about a potentially profound impact to commuters. For those who do not know the term, Vehicle Miles Travelled (VMT), is a measure of distance people must drive to/from work, and how many people are on our roadways at a given time. Put another way, it's the two driving forces of traffic congestion. I think this is something that needs absolute clarity before moving forward.

I would like to make clear, **I am currently not opposed to this project**; however, this is the point on the timeline where certain decisions will produce long lasting and permanent effects for our city. I appreciate that the EIR is critical to the project's success as well as Costa Mesa's. So, to ensure both parties are maintaining fairness and transparency, **I would like all governing bodies to consider using a 3rd party reputable, unbiased, and unaffiliated (to the city or developer) reviewer to report on the validity of the traffic analysis**. Preferably a 3rd party that does not service developers. P31-2

Additionally, we do not need another Specific Plan designed to target just this project. We already have a **North Costa Mesa Specific Plan** that will require amendments to make this project viable. I hope that the city's governing bodies refrain from tunnel vision when amending the North Costa Mesa General Plan solely to accommodate one special exception. P31-3

In fact, **the city should incorporate into its framework a holistic Urban Planning Strategy for the entire South Coast Plaza sector.** Doing so would allow the OMW project to flourish; we would have future economic opportunities for development, along with a sustainable, more affordable community North of the 405 Fwy. P31-4

At this juncture, myself and other community members would like to support this project provided the public is given <u>direct</u> answers and information for further review regarding the following points:

1. Like any development, the success of this project in contingent upon realistic VMT modeling, results, assumptions, and inputs. <u>I strongly propose a requirement that EIR's traffic analysis results (including VMT) as well as all assumptions and inputs are disclosed in a way that can be validated by a neutral 3rd party</u>. P31-5

2. Regarding bike trails and walkable areas – There is already an existing trail to and from the OMW, <u>what additional enhancement or infrastructure is being proposed?</u> P31-6

3. The future residents of OMW will increase the demand for numerous public resources/services by parks & recreation, police, fire, network for homeless solutions, water, sanitary etc. The current EIR does not reflect details addressing this eventuality. <u>What commitments or compromises can you and the builder make to mitigate the burden of additional costs, and what is plan to ensure we have a reasonable method of paying for the new costs?</u> P31-7

4. How does this project provide a meaningful increase to open space available per capita to residents and/or the public? P31-8

5. We need an independent **<u>city fiscal analysis</u>**. The public should be able to comprehend this data, in easy to read language and format. Analysis should include the financial cost/debts and benefits taxpayers will likely incur. **Note**: just because we may incur a cost, doesn't mean we shouldn't work together with the builder. Tax- payers just need to know what this will cost our city, how it will be paid for, and the risk assessment level of the project. P31-9

According to the Census Bureau there is a pent-up demand for housing developments in Urban communities that serve work-at-home professionals. As people continue seeking housing near the beach, Costa Mesa does not offer sufficient opportunities to meet the trending demands at this time. This means there is a potential for significant revenue loss. A benefit of OMW is that residents will spend a majority of their time and money in their home city.

In 2018, with exception to Councilmembers Mansoor and Genis, this council on record opposed developers and any large housing projects in Costa Mesa. I hope that this position has changed considering the recent economic forecast for California. Housing is an important determinant for economic growth, upward mobility, health, and happiness. Quality housing attracts people, which in turn attracts businesses and jobs. These conditions are also impetus to educational and career improvements for families. P31-10

OMW is a real opportunity to guide the city in the right direction, not just after we realize the effects of the COVID-19 crisis, but for years to come if the urban planning is done prudently, but we only get one shot. P31-10 cont'd

Thank you kindly and stay well,

Michelle Figueredo-Wilson
797 Center Street
949-945-8159

P31. RESPONSES TO COMMENTS FROM MICHELLE FIGUEREDO-WILSON, MARCH 22, 2020.

P31-1 The commenter provides general concerns regarding uncertainty in the economy and pressures to meet State-mandated housing requirements. These comments are not related to the adequacy of the Draft EIR analysis and no response is required.

P31-2 The commenter raises concerns regarding the project's traffic analysis and requests an unbiased, reputable, and unaffiliated (to the City or applicant) third party review the validity of the Traffic Impact Analysis. The Traffic Impact Analysis was prepared by LSA Associates, Inc., and in coordination with the City's Transportation Division in terms of intersection study areas and methodology for trip generation; LSA is under contract to the applicant. The Traffic Impact Analysis was peer reviewed by Linscott, Law & Greenspan Engineers (LLG), under contract to the City's environmental consultant, Michael Baker International. The City's Transportation Division reviewed LLG's peer review comments in addition to the Transportation Division's independent review of the Traffic Impact Analysis. The peer review included multiple rounds of review and revisions before the Traffic Impact Analysis was approved by LLG and the City for inclusion in the Draft EIR.

P31-3 The commenter states that the City does not need another Specific Plan when the *North Costa Mesa Specific Plan* is already in place and can be amended to accommodate the proposed project. The *North Costa Mesa Specific Plan* does not include the project site and thus, is not applicable. A specific plan is intended to provide flexibility in the development of a particular area with specific development standards and regulations. The comment is a general opposition to the introduction of a new Specific Plan in the City and is not related to the adequacy of the Draft EIR's analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P31-4 The commenter recommends that the City incorporate a holistic Urban Planning Strategy for the entire South Coast Plaza area. This comment is not related to the adequacy of the Draft EIR's analysis; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P31-5 Refer to response to comment P31-2.

P31-6 The commenter questions what types of bicycle and pedestrian improvements are proposed as part of the project. As detailed in Draft EIR Chapter 3, *Project Description*, Sunflower Avenue from Cadillac Avenue to Hyland Avenue would be improved with bicycle paths, new sidewalks, street parking, and landscape medians to enhance the neighborhood from an industrial setting to a mixed-use residential area. Specifically, the project would include the following improvements to Sunflower Avenue from Cadillac Avenue to Hyland Avenue; refer to Draft EIR Figure 3-6, *Sunflower Avenue Improvements*:

- Narrow Sunflower Avenue from a four-lane roadway to a three-lane roadway with one travel lane in each direction with a center striped left turn lane;

2. Response to Comments

- Add a six-foot sidewalk, eight-foot parkway, seven-foot bicycle lane, seven-foot landscaped median, and seven-foot parallel parking lane on the southern side of Sunflower Avenue adjacent to the project site;

- Add a six-foot bicycle lane and two-foot striped buffer between the bicycle lane and the vehicle lane on the northern side of Sunflower Avenue; and

- Underground existing Southern California Edison poles and utility lines (only along the project frontage; although it may extend as far as Hyland Avenue, subject to coordination with the adjacent property owner).

The proposed improvements would also connect the new complete street section of Sunflower Avenue with a new landscaped bicycle trail proposed along the western side of the open space area. Improvements would then extend westward; these off-site improvement would include trail resurfacing and landscaping and would occur along the southwest portion of the project site westward to the utility easement before the Santa Ana River channel. An active transportation hub is also proposed within the open space area that may include bicycle lockers, bicycle storage, and repair facilities.

P31-7 The commenter states that the Draft EIR does not include analysis regarding the project's potential impacts on public services and utilities, including parks, police, fire, water, and solid waste. The project's impacts on parks, police, and fire services are fully analyzed in Draft EIR Section 5.12, *Public Services and Recreation*, and impacts on water and solid waste services are fully analyzed in Draft EIR Section 5.15, *Utilities and Service Systems*. As analyzed, project impacts regarding parks, police, water, and solid waste would result in less than significant impacts upon implementation of existing regulations, PPPs, and SCAs. Only fire services would result in potentially significant impacts even after implementation of existing regulations, PPPs, and SCAs, however these impacts would be reduced to less than significant levels upon implementation of Mitigation Measures PS-1 and PS-2. Mitigation Measure PS-1 would require the project to retrofit existing traffic signals along the response corridors from Costa Mesa Fire & Rescue Department (CMFD) Stations 1, 2, 4, 5, and 6 to include Emergency Vehicle Preemption. Mitigation Measure PS-2 would require the project to provide additional fire protection features in excess of minimum code requirements to ensure Building A and the associated parking garage design meet CMFD's fire apparatus access road and hose pull requirements. Overall, project impacts on parks, police, fire, water, and solid waste would be less than significant upon implementation of applicable existing regulations, PPPs, SCAs, and mitigation measures.

The commenter also raises concerns regarding homeless solutions. Homelessness is not an environmental topic requiring analysis under CEQA. However, this concern is acknowledged by the City and the comment has been provided to the City decision makers for consideration.

P31-8 Refer to response to comment O2-7 regarding open space impacts per capita to residents and/or the public.

P31-9 The commenter requests a City fiscal analysis to evaluate the financial costs and benefits taxpayers would likely incur with project implementation. It is acknowledged that the City has required a fiscal

2. Response to Comments

analysis be conducted. Approval of the Development Agreement by the City Council for the project is required as part of the entitlement process. This comment is not related to the adequacy of the Draft EIR analysis; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P31-10 The commenter generally supports projects with a residential component given the Statewide housing crisis. The commenter also states that quality housing will attract high quality businesses and jobs. These comments are acknowledged, but not related to the adequacy of the Draft EIR analysis and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Russell Toler
Sent: Friday, March 20, 2020 9:44 AM
To: MINOO.ASHABI@costamesaca.gov
Cc: Marc Perkins (via Google Docs); Jenna Tourje; dianne.russell@costamesaca.gov; barry.curtis@costamesaca.gov; byron.dearakal@costamesaca.gov; jeffrey.harlan@costamesaca.gov; kedarious.colbert@costamesaca.gov
Subject: Support for the One Metro West

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for the One Metro West

Dear Minoo:

I want to provide my support for the proposed One Metro West community. I was raised in this city, and am now raising my family in this city. We rent a two-bedroom apartment, and even though our rent is below market, we still struggle to stay here. Homeownership is virtually out of the question. Part of the reason that housing is so expensive in Costa Mesa is because of the artificial suppression of market supply through zoning.

If a developer wants to build 1,000 units in our city, we should be thrilled. Our role should be to figure out how best to make this happen. From my observation it looks like the developers behind One Metro West have done a fantastic job at community outreach, designing a quality product, and considering the greater context into which they are building. I would like to see our city take advantage of this project and use it as catalyst for thinking about what our vision actually *was* for that section of town before One Metro West came along, and what it *might be* with One Metro West. Likewise, it might spur us to think about what our actual vision is for other parts of town as well. From what I can tell, One Metro West has provided something resembling a physical vision of what the north part of town might actually aspire to. We would be wise to pay attention. P32-1

The fact that they are in the middle of our city's employment hub, adjacent to the Santa Ana River Trail, providing real improvements to adjacent rights of way, and taking care to provide quality building frontages to frame our public space is, frankly, enough to earn my vote. This is not to mention that they are building over 1,000 units because they know that people *will want to live there*.

Obviously Costa Mesa is an urbanized area. To provide more places for people to live within an urbanized area is the environmentally responsible thing to do. The City's role should be to figure out how the north part of Costa Mesa might evolve into a place where these 1,000+ households can thrive without needing to drive everywhere. The developers can only do so much. The City needs to step it up too.

Sincerely,

Russell Toler
287 Costa Mesa St.

P32. RESPONSES TO COMMENTS FROM RUSSELL TOLER, MARCH 22, 2020.

P32-1 The commenter generally supports the proposed project and introduction of over 1,000 residential units in Costa Mesa to help meet the City's local housing demands. The commenter is also supportive of the overall project design, multimodal improvements, and open space area proposed. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

Paradigm Engineering Group
427 E. Seventeenth Street Suite #261
Costa Mesa, California 92627
909-898-1692 / Fax 498-7422

March 23, 2020

City of Costa Mesa
Planning Division
Attn: Ms. Minoo Ashabi, Principal Planner
77 Fair Drive
Costa Mesa, CA 92626

Re: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P33-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Paradigm Engineering Group

Peter M Olah 3/23/20

Peter M Olah
President
petermolah@hotmail.com
(909) 898-1692

P33. RESPONSES TO COMMENTS FROM PETER OLAH, MARCH 23, 2020.

P33-1 The commenter generally supports the proposed project, particularly the introduction of more housing, jobs, and multimodal improvements in close proximity to existing employment and residential developments. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P34

John C. Merrill
2893 El Rio Circle
Costa Mesa, CA 92626

City of Costa Mesa
77 Fair Drive
Costa Mesa, CA 92626

To whom it may concern:

I have reviewed the Draft Environmental Impact Report for the One Metro West project and offer the following feedback and comments.

My overarching concern on this project is how VMT has been calculated and whether the methodology presented in the TIA adequately captures the congestion and inducement impacts that would result. I would like to see more information disclosed to the public so that VMT analysis results can be interpreted by the public, as well as fellow traffic engineers and other planning professionals. P34-1

- EIR General:
  - Please provide detailed explanation <u>how</u> the project will reduce VMT, particularly for lower-wage service and retail jobs that are in proximity to the site, yet contains only a small amount of affordable housing. P34-2
  - Project is such a major change in land use, that it would appear to be remarkably incompatible with adjacent and nearby land uses. This is inconsistent with "smart growth" principles and is not incremental land use development. How does the project intend to integrate with the surrounding industrial land uses? P34-3
  - The EIR makes reference to a One Metro West Specific Plan, yet such a Plan does not currently exist on file with the City. How can this Plan be a mitigation if it does not already exist and has not been approved? Why can the project not be integrated into the North Costa Mesa Specific Plan, to coordinate land uses north of I-405? P34-4
- TIA General:
  - It should be noted that all freeway counts taken at ramps in 2019 are likely to not reflect true volumes due to general diversion to avoid construction on I-405. How has this been accounted for in the traffic analysis? P34-5
- Section 5.1:
  - "Trip credits were taken for the existing industrial use to be demolished for the development of the project. The credits were calculated by obtaining existing peak hour and daily counts at the existing project driveways." P34-6
    - In reviewing Table 5-A, the trip generation shown does not correspond to these counts. Please explain methodology or use a conservatively higher estimate of actual cordon counts for this underutilized industrial facility.
  - "Since the project is a mixed-use development, it is estimated that a certain percentage of trips between the land uses will be made on site and these internal trips do not utilize the major street system. The internal trips can be made either by walking within the project site or by vehicles using internal roadways without using external streets. An internal capture rate of 10 percent was used for both residential and non-residential uses based on City experience at other South Coast Metro locations. " P34-7

- This is an unusually high internal capture rate. Please provide supporting documentation for this assumption provided the surrounding industrial uses. P34-7 cont'd
  - "Vehicular trip reductions could be greater when considering the local context of attractions, destinations and networks linking them. "
    - Please provide an estimate with assumptions clearly stated to support potential active transportation mode shift given a typical pedestrian walkshed and bicycle rideshed. P34-8
- Section 5.2:
  - "The project trip distributions were developed using select zone model runs obtained from OCTAM. Three separate distributions were considered for the existing use, and the proposed residential and non- residential uses. "
    - This statement is not entirely accurate. Only 1 non-residential use (office) was run, and retail runs were not performed. P34-9
    - As you are aware, the project is premised by its ability to not significantly increase VMT due to shorter home-based trips and home-based work trips. Please provide a table of trips per TAZ coded into the OCTAM model, for each major land use analyzed.
- Section 11.3, Residential use:
  - "As shown in Table 11-A, the VMT per capita for the project is 18% less than the regional VMT per capita under existing (2019) conditions. The differences (18%) is lower than threshold of 15% as suggested in the TA. Therefore, although the City is yet to adopt thresholds for VMT impacts, based on the TA, the residential component of the project will not have a significant transportation impact." P34-10
    - This reduction in VMT seems unlikely given the incompatible land uses proximate to the project. As you are aware, the project is premised by its ability to not significantly increase VMT due to shorter home-based trips. Please provide a table of trips per TAZ coded into the OCTAM model, for each major land use analyzed.
- Section 11.3, Non-residential use (office):
  - "As shown in Table 11-A, VMT per employee for the project is 3% higher than the regional average under existing conditions. The TA suggests that the VMT per employee for office uses are required to be 15% lower than the regional average. Therefore, although the City is yet to adopt thresholds for VMT impacts, based on the TA, the office component of the project may have a significant transportation impact."
    - Although the City does not currently have an impact threshold for VMT incorporated into the General Plan, an increase of 3% over the State recommendation is worth noting. Even though it may not be considered an "impact" due to a technicality, it will undoubtedly be significant to the traveling public with increased congestion. P34-11
    - **Note to City Council: you should enact a General Plan amendment for a policy change to create a VMT impact threshold in order to close this loophole.**
- Section 11.3, Non-residential use (retail):
  - "The project retail component is a minor component of the project with only nine anticipated retail employees. As such, the retail (supermarket) will primarily be used by residents of the project and will be a local serving retail development that will help reduce home-based retail trips and thereby reduce VMT. Additionally, as stated in the TA, for mixed-use projects, only the "project's dominant use" may be considered for VMT analysis. Since, the retail component of the proposed project is not a major component and will primarily serve residents of the project itself, a separate VMT assessment has not be considered." P34-12
    - This statement seems inconsistent with claims made in Table 5-A. Retail and other commercial uses seem to generate a reasonable amount of traffic, particularly in the PM peak hour (55 vehicles in and out), and a major selling point to reduce home-based work

trips. In fact, this use has the highest overall peak hour trips. Please provide clarification and explanation for excluding such a large component. P34-12 cont'd

- Section 11.4:
  - "The project still intends to provide several transportation demand management (TDM) measures intended to reduce further the overall VMT from the project."
    - For each of the TDM measures listed, please provide:
      - Specific targets for VMT reduction by strategy
      - Agency or organization responsible for implementation
      - Method of continued monitoring for compliance (e.g., how this is included in a development agreement)

    P34-13
  - "It is also recognized that the project would add housing to an area within walking distance to employment, services, retail, restaurant and entertainment. As envisioned, the project would enhance the pedestrian user experience, improve the City's jobs/housing ratio, diminish VMT per capita, and support implementation of new or alternative TDM measures."
    - This statement would seem to contradict findings in Section 11.2, Non-residential use (office).
    - Please provide an approximate count of the number of restaurant and entertainment venues within a typical walkshed distance.

    P34-14
  - There does not seem to be any discussion about the very large increases in VMT in the 2040 Horizon Year baseline (see Appendix H). Please provide similar discussion and analysis as the 2019 baseline. This future congestion would present a significant challenge for residents in Costa Mesa if the General Plan were completely built out. P34-15

When I first learned of the One Metro West project during my service on the Bikeway and Walkability Committee, it seemed like a unique opportunity to provide housing to employees, particularly those who typically work in retail or service industry jobs that are prevalent here in Costa Mesa. I am extremely supportive of "live-work" development in a contextually appropriate setting, but I don't think this project is quite there yet. I do however still see potential. P34-16

Respectfully submitted,

John C. Merrill, PE, TE

P34. RESPONSES TO COMMENTS FROM JOHN MERRILL, MARCH 23, 2020.

P34-1 This introductory comment states the commenter's overarching concern regarding how vehicle miles traveled (VMT) is calculated in the project's Traffic Impact Analysis (TIA) and whether the methodology presented in the TIA adequately captures the congestion and induced project impacts. Responses to specific comments within the comment letter are provided below.

P34-2 The commenter requests an explanation as to how the project would reduce VMT, particularly for lower-wage service and retail jobs that are in proximity to the site, yet contains only a small amount of affordable housing. It is acknowledged that available jobs in the project area are not limited to lower-wage service and retail jobs, but also include light-industrial and office/corporate jobs as well. VMT is a measurement of vehicle miles traveled per capita within a specific area and timeframe. As analyzed in Section 5.13, *Transportation*, of the Draft EIR, the residential component of the project would place housing in the vicinity of multiple employment centers, including the neighboring industrial and commercial uses, thereby resulting in less VMT than the Orange County region. On the other hand, the office component of the project would place a job-generating use (i.e., the Creative Office Building) in an area of the City that is already jobs-rich, thereby resulting in slightly greater VMT than the Orange County region; refer to Draft EIR Table 5.13-13, *Existing Regional and Project VMT Comparison*. It should be noted the current methodology for VMT projections do not include a mixed-use scenario applicable to this site. As such, each use was analyzed separately for VMT projections.

Additionally, per instructions from the State of California Governor's Office of Planning and Research (OPR), VMT is calculated per capita and per employee only. There is no mention of income classes or indication of affordable housing in the recommended methodology. Furthermore, income class and housing affordability are not data elements of typical traffic forecasting tools used for traffic volume forecasting or VMT estimation.

P34-3 The commenter is concerned that the project is a substantially incompatible land use within the surrounding area. In addition to the nearby light industrial uses, the project site is also located adjacent to the South Coast Collection (SOCO) and The OC Mix, which are commercial centers with a farmers market, retail stores, boutiques, restaurants, and showrooms. Therefore, locating the proposed mixed-use development with housing, office, retail, and open space near these existing employment and entertainment areas would be compatible. It is acknowledged that a General Plan Amendment and Zone Change would still be required as part of the project. However, as analyzed in Draft EIR Table 5.9-1, *Project Consistency with General Plan*, the project would be generally consistent with applicable General Plan policies, including those related to land use, circulation, growth management, housing, conservation, noise, safety, community design, open space and recreation, and historical and cultural resources.

P34-4 The commenter questions how the Specific Plan can be utilized as mitigation for the proposed development if it is not yet approved by the City Council. The Specific Plan is proposed as part of the project and, along with the Master Plan, would guide development of the project site with development standards and design guidelines related to setback, building height, parking, and amenity requirements for the proposed residential and non-residential uses. The Specific Plan is not mitigation to reduce potentially significant impacts associated with the development but is rather part of the overall project development.

The commenter suggests integrating the project into the existing *North Costa Mesa Specific Plan*. The project site is not located within the *North Costa Mesa Specific Plan* area and thus, is not applicable to the project. This comment is not related to the adequacy of the Draft EIR analysis. Thus, no additional response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P34-5 The commenter notes that traffic counts conducted in 2019 as part of the TIA are likely not reflective of true traffic volumes given the general diversion of traffic to avoid construction activities on the I-405 Freeway related to the I-405 Improvement Project. As stated in Draft EIR Section 5.13, *Transportation*, existing traffic volumes are based on a.m. and p.m. peak hour turning movement counts collected by Counts Unlimited in March 2019. However, due to ongoing construction activities related to the I-405 Improvement Project, some of the I-405 ramps on Fairview Road remained closed at the time the counts were collected. Also, some of the traffic on Fairview Street/Fairview Road was diverted because of the closure. Hence, for all the intersections on Fairview Street/Fairview Road, counts collected by Counts Unlimited in September 2018, before the beginning of construction activities, were used instead. A one percent growth was added to the September 2018 counts at the study intersections along Fairview Street/Fairview Road to develop year 2019 counts at these intersections. Detailed count sheets are provided in TIA Appendix A, *Traffic Count Sheets*.

P34-6 The commenter states that the trip credits taken for the existing industrial use do not correctly correspond to the counts detailed in TIA Table 5-A, *Project Trip Generation*, and requests an explanation of the methodology. Table 5-A, *Project Trip Generation*, of the TIA correctly details the existing peak hour trips generated by the industrial building (429 average daily trips with 37 a.m. peak hour trips and 8 p.m. peak hour trips) based on driveway counts collected on September 11, 2019; refer to TIA Appendix A, *Traffic Count Sheets*. At the bottom of TIA Table 5-A, *Project Trip Generation*, the 'Project Trip Generation' is a sum of the 'Net Project Trip Generation (Residential)' and 'Net Project Trip Generation (Non-Residential)' minus the existing industrial building peak hour trips (i.e., the trip credits). Existing trip generation associated with the industrial building was based on driveway counts (a.m. and p.m. peak hours and daily trips) collected on September 11, 2019; refer to Appendix F-4, *Existing Driveway Counts*.

P34-7 The commenter states that an internal capture rate of 10 percent is unusually high and requests supporting documentation for this assumption. As stated, the 10 percent internal capture rate was utilized based on City experience with other mixed use projects in Costa Mesa, including the South Coast Metro area and higher capture rates for mixed use developments in the Institute of Transportation Engineers' Trip Generation Manual. The Orange County Traffic Analysis Model indicated a greater internal capture percentage between the project's land uses. Therefore, the 10 percent internal capture rate was used as a more conservative estimate.

P34-8 The commenter requests an estimate of additional vehicular trip reductions (in addition to the 10 percent internal capture rate and trip credits) based on the project's proposed active transportation improvements (e.g., bicycle amenities, Santa Ana River Trail connections, and pedestrian improvements along Sunflower Avenue) and the proximity of other destinations and attractions within walking distance (e.g., SOCO and The OC Mix). The TIA analysis does not take into account additional vehicular trip reductions associated with the project's active transportation improvements, only the 10 percent internal capture rate and trip credits for the existing industrial use were taken. The sentence cited from the TIA in this comment is generally stating that additional vehicular trip reductions could occur should these active transportation improvements be considered in the project's overall net trip generation. As such, a quantified estimate of these vehicular trip reductions would be speculative and is not warranted. Further, the current analysis presents a conservative assumption for the project's traffic impacts and the addition of the requested information in the Draft EIR and/or TIA would not result in new identified transportation impacts or new mitigation measures.

P34-9 The commenter states that the project trip distributions did not consider residential, office, and retail uses and requests a table of trips per traffic analysis zone coded into the Orange County Traffic Analysis Model for each major land use analyzed. The trip distribution assignments are consistent with the underlying model traffic data. Non-residential runs account for both of the project's office and retail land uses given that the retail component of the project is a small part of the overall development. Additionally, project trips are not coded into the traffic model. The model utilizes socio-economic data to forecast trips by traffic analysis zone and thus, was coded in the Orange County Traffic Analysis Model for each land use type and the project trips were obtained from the model outputs.

P34-10 The commenter states that the project's anticipated reduction in residential VMT compared to regional VMT seems unlikely given the incompatible land uses proximate to the site and requests a table of trips per traffic analysis zone coded into the Orange County Traffic Analysis Model for each major land use analyzed. The proposed project is primarily a residential project. The model was utilized per standards set by the Orange County Transportation Authority following the recommendations by OPR for calculating VMT. Project trips are not coded into the model, but are based on the model outputs.

P34-11 The commenter states that even though the City does not have an established VMT threshold, the VMT generated by the project's office component, which is higher than the Orange County region, is worth noting. The Draft EIR does conservatively conclude that impacts related to VMT are significant and unavoidable due to the creative office use's three percent increase in VMT compared to the region.

The commenter also states that the City Council should adopt a VMT threshold to close the "loophole." OPR developed alternative metrics and thresholds based on VMT. Although the new CEQA Guidelines were certified by the Secretary of the Natural Resources Agency in December 2018, lead agencies have until July 1, 2020 to adopt new VMT-based criteria for evaluating traffic impacts. OPR also published a *Technical Advisory on Evaluating Transportation Impacts in CEQA* in December 2018 to provide technical recommendations regarding assessment of VMT, thresholds of significance, and mitigation measures. Separate from the proposed project, the City is currently in the process of establishing and adopting VMT thresholds. In the meantime, for the purposes of this EIR, OPR's

Technical Advisory on Evaluating Transportation Impacts in CEQA is being used for the purpose of analyzing the project's VMT impacts.

P34-12 The TIA states that the retail component of the project is minor with only nine anticipated retail employees, thus, a separate VMT assessment is not considered for the retail use. The commenter is concerned about this approach and states that although nominal compared to the residential and office components of the project, the retail component would generate a reasonable amount of traffic, particularly in the p.m. peak hour (approximately 55 vehicle trips). Approximately 55 p.m. peak hour trips is minimal and would not constitute a significant enough volume to warrant a traffic study per the City's Traffic Impact Analysis guidelines. Additionally, based on OPR's *Technical Advisory on Evaluating Transportation Impacts in CEQA*, lead agencies can evaluate each component of a mixed-use project independently and apply the significance threshold for each project type included (e.g., residential and retail). Alternatively, a lead agency may consider only the project's dominant use. As such, the VMT analysis considers only the project's dominant uses (i.e., residential and office) and analyzes each use separately.

P34-13 For each transportation demand management (TDM) measure proposed by the project, the commenter requests quantified targets for VMT reduction, identification of the implementing party, and method for monitoring/compliance. The TDM measures detailed in TIA Section 11.4, *VMT Reduction Strategies*, would further reduce the overall VMT generated by the project; however, they are not quantified as part of the project's residential and office VMT. The TDM measures include pedestrian and traffic calming measures (e.g., new sidewalks, bicycle lanes, and restriping along Sunflower Avenue), which are detailed in Chapter 3, *Project Description*, of the Draft EIR. These are proposed as part of the project and would be implemented during project construction. The car-sharing programs, encouraged telecommuting and alternative work schedule, and ride-sharing programs would be implemented by the future property manager(s) of the residential buildings and tenants of the creative office building. As these TDM measures cannot be easily monitored like the project's mitigation measures, they are not quantified in this analysis to reduce potentially significant impacts. As quantifying these measures would be speculative, these VMT reductions are not specifically included in the calculations, but rather just acknowledged.

P34-14 The commenter indicates a sentence in the TIA contradicts the findings associated with the project's office-related VMT. Refer to responses to comments P34-10 and P34-11.

P34-15 The commenter requests an analysis of the VMT impacts in the 2040 scenario as shown in TIA Appendix H, *VMT Calculation Worksheet*. As detailed, VMT impacts for the residential and office components of the project would result in similar impacts under existing 2019 and 2040 conditions (since this analysis is based on added vehicle miles traveled and not necessarily traffic congestion). However, per the direction of OPR, the VMT analysis is to be provided for existing conditions, not for future conditions.

P34-16 The commenter generally supports live-work developments in a contextually appropriate setting but feels the project has some shortfalls. This comment is not related to the adequacy of the Draft EIR analysis and thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P35

From: Robin Leffler <wre2lef@sbcglobal.net>
Sent: Monday, March 23, 2020 4:48 PM
To: ASHABI, MINOO
Subject: Attn: One Metro West DEIR comments

City of Costa Mesa
Minoo Ashabi, Principal Planner,
Planning Services Department
City of Costa Mesa

I have a few comments on the One Metro West EIR in the form of requests for analysis of certain impacts to the adjacent neighborhood of Mesa Verde, that are lacking from the document presented.

The following traffic analysis are lacking from the EIR:
As any one living in Mesa Verde knows, Mesa Verde Drive has heavy cut-through Traffic at peak hours. Country Club between Mesa Verde Drive and Gisler, and Baker also are heavily trafficked at rush hour. Please provide analysis of peak hour traffic increases due to the proposed One Metro West projected on these residential roadways already negatively impacted by cut-through traffic. P35-1

I will echo my fellow Mesa Verde Community Board member Rus Pucell's statement that the massive project would block a great deal of the airspace visible to the north of the project, both in it's present inception or in a modified alternative offered, Furthermore, it would block air circulation., Another important area of concern is that it would increase light pollution at night in the Upper Mesa Verde area. P35-2

I echo the conclusion of my acquaintances Rus Purcell and Terry Wall: the only acceptable alternative to the project is the NO PROJECT/NO DEVELOPMENT option.

Robin Leffler
Mesa Verde Resident
3000 Ceylon Road, Costa Mesa 92626
714 546 1452

From: webmaster@costamesaca.gov <webmaster@costamesaca.gov> on behalf of City of Costa Mesa <webmaster@costamesaca.gov>
Sent: Monday, March 23, 2020 4:52 PM
To: ASHABI, MINOO
Subject: City of Costa Mesa: One Metro West

You have received this link from Robin Leffler < wre2lef@sbcglobal.net > for the following page:

https://www.costamesaca.gov/city-hall/city-departments/development-services/planning/one-metro-west

The following are comments on the One Metro West EIR which I sent earlier by regular email City of Costa Mesa Minoo Ashabi, Principal Planner, Planning Services Department City of Costa Mesa I have a few comments on the One Metro West EIR in the form of requests for analysis of certain impacts to the adjacent neighborhood of Mesa Verde, that are lacking from the document presented. The following traffic analysis are lacking from the EIR: As any one living in Mesa Verde knows, Mesa Verde Drive has heavy cut-through Traffic at peak hours. Country Club between Mesa Verde Drive and Gisler, and Baker also are heavily trafficked at rush hour. Please provide analysis of peak hour traffic increases due to the proposed One Metro West projected on these residential roadways already negatively impacted by cut-through traffic. I will echo my fellow Mesa Verde Community Board member Rus Pucell's statement that the massive project would block a great deal of the airspace visible to the north of the project, both in it's present inception or in a modified P35-3 alternative offered, Furthermore, it would block air circulation., Another important area of concern is that it would increase light pollution at night in the Upper Mesa Verde area. I echo the conclusion of my acquaintances Rus Purcell and Terry Wall: the only acceptable alternative to the project is the NO PROJECT/NO DEVELOPMENT option. Robin Leffler Mesa Verde Resident 3000 Ceylon Road, Costa Mesa 92626 714 546 1452 P35-3 cont'd

P35. RESPONSES TO COMMENTS FROM ROBIN LEFFLER, MARCH 23, 2020.

P35-1 The commenter identifies several residential roadways within the Mesa Verde community that would be adversely impacted by the project and requests peak hour traffic analysis along such roadways. As detailed in Draft EIR Section 5.13, *Transportation*, the study area intersections analyzed in the TIA were identified per the City's Traffic Impact Analysis guidelines, which is based on intersections where the project would add 50 or more peak hour trips. Given that the residential roadways identified by the commenter would not result in 50 additional trips upon project implementation, they were not included in the project's traffic impact analysis. Generally, a traffic impact analysis is focused on roadways that would experience at least a certain number of added trips based on each jurisdiction's local traffic analysis guidelines.

The study intersections closest to the Mesa Verde neighborhood include Harbor Boulevard/Gisler Avenue (Study Intersection No. 14), Harbor Boulevard/Nutmeg Place (Study Intersection No. 15), and Harbor Boulevard/Baker Street (Study Intersection No. 16). As shown in Traffic Impact Analysis Figure 5-2, *Project Trip Distribution – Residential*, only one percent of outbound residential trips from the project site are anticipated to turn onto Gisler Avenue from Harbor Boulevard into the Mesa Verde neighborhood. No other inbound or outbound residential trips are anticipated to turn into the Mesa Verde neighborhood. Further, as shown on Figure 5-3, *Project Trip Distribution – Non-Residential*, only one percent of outbound non-residential trips from the project site are anticipated to turn onto Gisler Avenue and Nutmeg Place from Harbor Boulevard into the Mesa Verde neighborhood. No other inbound or outbound non-residential trips are anticipated to turn into the Mesa Verde neighborhood. Therefore, the neighborhood would not be converted into a thoroughfare to the proposed development as the roadways are all located south of the freeway and predominantly end in cul-de-sacs or loops within the neighborhood.

P35-2 The commenter raises concerns regarding the proposed buildings impacts on visible airspace, air circulation, and light pollution. Building A would have a maximum building height of six stories; Buildings B and C would have maximum building heights of seven stories; and the Creative Office Building would have a maximum building height of three stories. Refer to response to comment O2-2 regarding aesthetics impacts related to proposed building heights. As summarized, per Draft EIR Table 5.1-1, *Project Consistency with the Costa Mesa General Plan*, the proposed project would be consistent with relevant General Plan goals, objectives, and policies pertaining to scenic quality (including consideration of proposed building heights as applicable). Impacts regarding the potential to conflict with applicable zoning and other regulations governing scenic quality were determined to be less than significant.

The commenter states that the proposed buildings would block air circulation in the project area. CEQA environmental topic areas of concern do not include air circulation; no further response is required in this regard as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

2. Response to Comments

Project impacts regarding light pollution are analyzed in Section 5.1, *Aesthetics*, of the Draft EIR. The proposed project is located within a developed area of the City and currently developed with an industrial building. As a result, various sources of light and glare are currently present in the project area. Project implementation would result in additional sources of lighting through the development of new residential structures, parking garages, an office building, and open space amenities. However, parking structure lighting would be designed to minimize light spillover and installed to concentrate light on pedestrian and vehicle aisles and ramps with spillover lighting adequate to illuminate parking stalls (refer to PPP AES-2). Further, in order to reduce impacts related to light and glare from the proposed parking façade, the Specific Plan includes development standards which specify project lighting requirements to ensure exterior lighting is shielded and directed downward, or otherwise directed away from off-site properties. The development standards also stipulate that project lighting adjacent to the I-405 Freeway would be required to meet applicable Caltrans standards. An Exterior Lighting Plan would be required, prior to issuance of the first building permit, that identifies and depicts locations, design, types, scale, and illumination power of lighting fixtures, including on all building exteriors and within the open space/trail connection areas. SCA AE-5 would require preparation of a Lighting Plan and Photometric Study for review and approval by the City's Development Services Director. The Lighting Plan and Photometric Study would include performance standards to minimize the project's potential to result in lighting impacts. Further, Mitigation Measure AE-1 would ensure the project's Lighting Plan and Photometric Study required under SCA AES-5 include additional lighting performance measures to demonstrate the project lighting meets minimum security lighting requirements and minimizes lighting impacts to surrounding uses. Specifically, Mitigation Measure AE-1 would ensure the parking structure façade artistic treatment includes light shields or baffles to eliminate glare to travelers along the I-405 Freeway and limits illumination levels. With implementation of Mitigation Measure AE-1, impacts regarding light pollution would be reduced to less than significant levels.

P35-3 Refer to responses to comments P35-1 and P35-2, pertaining to traffic and light pollution, respectively.

COMMENT LETTER P36

From: Shawn McBride <trinug@yahoo.com>
Sent: Monday, March 23, 2020 9:06 AM
To: ASHABI, MINOO
Subject: One Metro West

Dear Mrs. Ashabi:

As a resident of Costa Mesa since 2001, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.

The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.

It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods. P36-1

There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa.

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well. P36-1 cont'd

Sincerely,

Shawn McBride
1814 Fullerton Ave.
Unit B
Costa Mesa, CA 92627

P36. RESPONSES TO COMMENTS FROM SHAWN MCBRIDE, MARCH 23, 2020.

P36-1 The commenter generally supports the proposed project, including the introduction of housing north of the I-405 Freeway and development of residential, employment, and retail within one neighborhood. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Tracey Valencia <t.emmons76@gmail.com>
Sent: Monday, March 23, 2020 9:37 AM
To: ASHABI, MINOO
Subject: One Metro West

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for the One Metro West

Dear Minoo:

As a resident of Costa Mesa since 2006, I gladly support the proposed One Metro West community.

The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day. P37-1

It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.

A strong housing policy should be a part of our civic north star. This includes all kind of housing, for-sale and for-rent (both market and affordable). Housing is at the core of so many of societal' s issues (transit, global warming, inequity, segregation, economic growth, generational wealth gaps, etc). Having a healthy housing market which reacts appropriately to all this issues is fundamental to the solutions for same. P37-1 cont'd

As Costa Mesa looks to the future, ideas like One Metro West are roundly supported by economists and environmentalist alike. For these reasons, I am supportive this plan and community.

Sincerely,

Tracey Valencia
674 W 18th Street
Costa Mesa, 92627

P37. RESPONSES TO COMMENTS FROM TRACEY VALENCIA, MARCH 23, 2020.

P37-1 The commenter generally supports the proposed project, including the introduction of housing (both market and affordable) north of the I-405 Freeway. The comment is acknowledged; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P38

From: Jose De La Jara <jdelajara@yahoo.com>
Sent: Monday, March 23, 2020 6:31 PM
To: ASHABI, MINOO
Subject: One Metro West Project

Dear Mr. Minoo Ashabi -

As a life long resident of Costa Mesa and involved community member, I have watched the One Metro West community proposal develop in detail. What has me more impressed is their level of involvement and commitment to the community and that their approach will add much needed housing for all types of Costa Mesa residents and those that work here while not changing the traditional neighborhoods many of our residents call home south of the 405 or near South Coast Metro.

In addition, by adding a new 1.5 acre open space on what is now a decades old industrial site, every member of the public can start to see how our community is better together which is one of the goals at Trellis that Rose Equities and the One Metro West community have worked to help make a reality. P38-1

Costa Mesa has an established, recognized need for housing and the approved and under development projects north of the 405 show that the need for housing will continue to grow. By approving One Metro West, Costa Mesa will be providing a realistic and positive solution for many residents, employers, and new employees looking for housing that does not require long work commutes or drives for shopping, restaurants, and entertainment.

I look forward to continuing to support One Metro West in the future and appreciate your consideration of our thoughts in this project moving forward.

Sincerely,

Jose De La Jara
Costa Mesa Resident

P38. RESPONSES TO COMMENTS FROM JOSE DE LA JARA, MARCH 23, 2020.

P38-1 The commenter generally supports the proposed project, particularly the introduction of housing north of the I-405 Freeway, which would minimize impacts to existing neighborhoods south of the I-405 Freeway and near South Coast Metro. The commenter is also supportive of the revitalization of the underutilized industrial site with open space and trail improvements. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

Project Independence
Enriching Lives. Expanding Choices.

March 23, 2020

Minoo Ashabi
City of Costa Mesa
Via Email

Re: One Park West Support

Dear Minoo Ashabi -

For over forty years Project Independence has made the Sunflower corridor our home. From this central point we have served hundreds of adults with developmental disabilities throughout Orange County. During our many years at our headquarters we have watched the neighborhood change from industrial warehouse to flex space for assembly and manufacturing, to its current mixed use of office and warehousing.

For these past few years we have excitedly watched as One Metro West developed a new vision and wonderful addition to the region of residential, office, and open spacing. We could not be more excited. The combination of repurposing a land area currently used as manufacturing and shipping into much-needed housing and local resources is brilliant. As a neighbor we will have access to retail sources not currently available near us, the life energy that comes with high-end residential units and open park spaces which will allow us a location for our clients to walk and socialize without the need for transporting and the expenses associated. P39-1

I, as well as our entire organization, wholeheartedly embrace this valuable addition to our neighborhood. The pros strongly outweigh the limited drawbacks and should be enthusiastically supported by the City of Costa Mesa.

Sincerely,

Todd Eckert
Director of Development
Project Independence

3505 Cadillac, Suite O-103, Costa Mesa, CA 92626
Tel: 714-549-3464 - Fax: 714-549-3559 - www.proindependence.org

From: Todd Eckert <todd@proindependence.org>
Sent: Monday, March 23, 2020 6:35 PM
To: ASHABI, MINOO
Cc: jgibson.ocg@gmail.com
Subject: Support for One Metro West

Dear Minoo Ashabi -

For over forty years Project Independence has made the Sunflower corridor our home. From this central point we have served hundreds of adults with developmental disabilities throughout Orange County. During our many years at our headquarters we have watched the neighborhood change from industrial warehouse to flex space for assembly and manufacturing, to its current mixed use of office and warehousing.

For these past few years we have excitedly watched as One Metro West developed a new vision and wonderful addition to the region of residential, office, and open spacing. We could not be more excited. The combination of repurposing a land area currently used as manufacturing and shipping into much-needed housing and local resources is brilliant. As a neighbor we will have access to retail sources not currently available near us, the life energy that comes with high-end residential units and open park spaces which will allow us a location for our clients to walk and socialize without the need for transporting and the expenses associated. P39-2

I, as well as our entire organization, wholeheartedly embrace this valuable addition to our neighborhood. The pros strongly outweigh the limited drawbacks and should be enthusiastically be supported by the City of Costa Mesa.

Sincerely,

Todd Eckert
Director of Development
Project Independence

Sent from Todd's iPad 🌎

P39. RESPONSES TO COMMENTS FROM TODD ECKERT, MARCH 23, 2020.

P39-1 The commenter generally supports the proposed project, particularly the revitalization of the underutilized industrial site with housing, retail, office, open space, and trail improvements. The comment is acknowledged; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P39-2 Refer to response to comment P39-1.

COMMENT LETTER P40

23 May, 2020

To: Costa Mesa City Council and City Staff

Re: One Metro West – Letter of Support

To Whom It May Concern:

I am in favor of the captioned project. Our region needs more housing and the location is ideal. I write that haltingly as a Costa Mesa Resident that is extremely troubled by the financial choice-making of the current City Council majority. I sincerely hope, and have hoped prior to the current imminent economic recession, that we reduce spending now. The two relate as this development may result in the Council majority's patron, the Fire Department employee association, insisting that this development requires a new fire station. P40-1

So, to be clearer, as long as a new fire station is not the result of this development, I support it. And I note that I have met personally with the developer of the project more than a dozen times and understand it well, and have also read the EIR.

Sincerely,

Andrew Smith

Costa Mesa Resident

P40. RESPONSES TO COMMENTS FROM ANDREW SMITH, MARCH 23, 2020.

P40-1 The commenter generally supports the proposed project due to the need for more housing in Costa Mesa. However, the commenter caveats that he is in support of the proposed project so long as the project does not result in the need for a new fire station to be constructed. As analyzed in Draft EIR Section 5.12, *Public Services and Recreation*, the project would increase demand for fire services and would be required to implement Mitigation Measures PS-1 and PS-2 to reduce such impacts to less than significant levels. Mitigation Measure PS-1 would ensure existing traffic signals along the response corridors from CMFD Stations 1, 2, 4, 5, and 6 to the project site are retrofitted to include Emergency Vehicle Preemption. CMFD states that implementation of Mitigation Measure PS-1 is acceptable mitigation to incrementally improve response capabilities to the site. Further, in addition to compliance with standard fire protection requirements of the California Fire Code and referenced standards as adopted by the CMFD, the project is required to provide additional fire protection features on-site in excess of minimum code requirements to ensure Building A and the associated parking garage design meet CMFD's fire apparatus access road and hose pull requirements (Mitigation Measure PS-2).

CMFD also indicated that, although there are no current plans to increase the number of personnel service in the project area, additional staffing, apparatus, and facilities need to be considered. CMFD is currently conducting a comprehensive Citywide Standards of Coverage Assessment and deployment analysis that is independent of the proposed project. The City is also concurrently conducting a Development Impact Fee Study to account for similar changes of use that result in net increases to call volumes. In the meantime, to mitigate the impacts of the project-generated increase in anticipated calls for service, CMFD has accepted PPP FS-3, which requires the negotiation of fees through the project's Development Agreement with an understanding that the developer would be required to pay its pro-rata share of additional staffing and equipment. The project would be required to pay development impact fees established based on the Citywide Standards of Coverage Assessment and the Development Impact Fee Study and as required in the Development Agreement in accordance with PPP FS-3 and Municipal Code Section 13-270, *Establishment of Development Impact Fee*. The revenues raised by the development impact fee, the Development Agreement, and the proportionate revenues generated through the project's ongoing payment of taxes (and other similar project-related revenues) would fund fire protection staffing, facilities, and equipment and would offset the project's incremental impacts to fire services.

To clarify, project implementation itself would not result in the need to construct a new fire station. However, similar to other development projects within the City, the proposed project would be required to pay development impact fees, which would fund future fire protection service needs.

From: Jan Harmon <janharmon2008@gmail.com>
Sent: Tuesday, March 24, 2020 9:52 PM
To: OMW Public Comments
Subject: REGARDING PUBLIC REVIEW OF THE ONE METRO WEST DRAFT EIR

To OMWPublicComments@costamesaca.gov

REGARDING PUBLIC REVIEW OF THE ONE METRO WEST DRAFT EIR

March 24, 2020

Dear Mini Ashabi,

I have read the One Metro West Draft EIR (located at https://www.costamesaca.gov/home/showdocument?id=41025) and I have serious concerns how this project could benefit Costa Mesa. In fact, it will be a detriment to our city.

I have the following concerns:

1. The amount of traffic this project will create will put a burden on the already impacted traffic flow along Harbor Blvd and Fairview Blvd at the 405 freeway. The EIR contains a chart showing the current approved projects for the vicinity of One Metro West. I was shocked to see how many projects have already been approved that will be increasing traffic by 28,348 daily trips on our already impacted Costa Mesa Roads. According to the One Metro West EIR on page 5.13-26, the One Metro West project would add another 6,800 daily trips. P41-1
2. I do not like the idea of changing the zoning of the area of the proposed One Metro West to high density residential opening the area up to even more residential building projects and increased burden on Costa Mesa. P41-2
3. Further concerns I have are the project's impact on local schools, the impact to our emergency services and evacuation plan, and the increased demand on city services such as police and fire.

In conclusion, it is my feeling that the One Metro West project would be a burden on the City of Costa Mesa and should not be allowed to proceed. P41-3

Sincerely,
Jan Harmon, Costa Mesa resident since 1973
1859 Illinois St
Costa Mesa

714 546 4005

janharmon2008@gmail.com

P41. RESPONSES TO COMMENTS FROM JAN HARMON, MARCH 24, 2020.

P41-1 The commenter is concerned about the additional traffic that would be generated by the project, particularly along Harbor Boulevard and Fairview Boulevard near the I-405 Freeway, in addition to other cumulative projects identified in the Draft EIR. This comment is general concern regarding increased traffic in the City and not related to the adequacy of the Draft EIR analysis. Nevertheless, to clarify, the list of cumulative projects detailed in Draft EIR Table 4-2, *Related Projects*, are not necessarily approved yet. According to CEQA Guidelines Section 15130(b), the related projects are "past, present and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency." As such, some of the listed related projects may be on hold, in the environmental review process, approved, in plan check review, or in construction.

Section 5.13, *Transportation*, of the Draft EIR analyzes the project's incremental impacts on study area intersections and freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios. The future short-term cumulative (2027) and General Plan buildout (2040) scenarios take into account the related projects listed in Draft EIR Table 4-2, *Related Projects*.

P41-2 The commenter opposes the proposed Zone Change claiming that it would open the area to more residential building projects in the project area. The proposed Zone Change would only apply to the project site; all other surrounding uses adjacent to the project site would maintain their existing zoning of Industrial Park (MP) and Planned Development Industrial (PDI). Should a future residential project be proposed in the project area, it would be required to undergo a separate environmental review process under CEQA. As such, the proposed Zone Change would not establish a procedure that would make future re-designations and/or rezones easier and is not a precedent-setting action.

P41-3 The commenter raises concerns regarding project impacts on local schools, emergency services and evacuation plans, and police and fire services. The project's impacts on schools, emergency services, police, and fire services are fully analyzed in Section 5.12, *Public Services and Recreation*, and impacts on evacuation plans are evaluated in Section 5.7, *Hazards and Hazardous Materials*. As analyzed, the project would result in less than significant impacts to each of the identified topical areas with implementation of Mitigation Measures PS-1, PS-2, and HAZ-3.

From: Anne Marie Kane <anmrekn@gmail.com>
Sent: Monday, March 23, 2020 9:45 AM
To: ASHABI, MINOO
Subject: OMW - Letter of Support

Dear Mrs. Ashabi:
As a resident of Costa Mesa since 2011, I gladly support the proposed One Metro West community which will continue to build Costa Mesa's global reputation as an innovative and vibrant city.
The area of Costa Mesa north of the 405 has long served as the economic engine of the City. However, with its relative lack of housing, the traffic coming and leaving the area has put a strain on many of our traditional neighborhoods during the peak hours of the day.
It was great to see the city's Environmental Impact Report confirmed that the One Metro West community will serve as an ideal complement to the new and existing jobs north of the 405, drawing impactful traffic away from our nearby neighborhoods.
There is no doubt One Metro West will create citywide economic benefits for Costa Mesa residents and new opportunities for our local businesses. By rightsizing the community and enhancing the pedestrian network, residential can stay the neighborhood for dining, shopping, and work. Meanwhile, unnecessary traffic and disruption in our neighborhoods will be avoided. All the while, funds paid by the community will be used to improve parks and amenities in traditional neighborhoods like the one I call home. It's an ideal mixture of uses, with the 405 serving as a natural barrier to the rest of Costa Mesa. P42-1

Our city has grown as a community by being at the forefront of planning great neighborhoods, parks, retail, and I look forward to One Metro West being a part of that story as well.

Sincerely,

Anne Marie Kane
785 Center Street
Costa Mesa, CA 92627

P42. RESPONSES TO COMMENTS FROM ANNE MARIE KANE, MARCH 23, 2020.

P42-1 The commenter generally supports the proposed project, including the introduction of housing north of the I-405 Freeway and development of residential, employment, and retail within one neighborhood. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P43

March 23, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for the One Metro West

Dear Minoo:

As a Millennial resident of Costa Mesa, I wanted to discuss my support for the proposed One Metro West community.

There is an incredible demand for my generation for places to live near jobs and amenities. More importantly, places to live near upwardly mobile jobs which are so important to all of our futures. These are the types of jobs are prevalent in Costa Mesa's economic engine, north of the 405.

One Metro West is the ideal complement to these jobs, not only because they are bringing much needed housing, but because they are paying so much attention to the pedestrian. The walkable connection from the Santa Ana River Trail to One Metro West, SOCO, VANS and beyond are the needed building blocks for an area of Costa Mesa which has so much promise for the city's future. P43-1

Costa Mesa has grown as a city and a community by being at the forefront of planning great neighborhoods, parks and retail. One Metro West is the continuation of this tradition and is a great piece of Costa Mesa's future, which should be focused north of the 405.

Sincerely,

Devin Green
2853 Boa Vista Dr.
Costa Mesa, CA 92626

P43. RESPONSES TO COMMENTS FROM DEVIN GREEN, MARCH 23, 2020.

P43-1 The commenter generally supports the proposed project, including the introduction of housing, jobs, and amenities all within one neighborhood. The commenter also supports the proposed pedestrian improvements that would connect the Santa Ana River Trail to the project site, SOCO, and beyond. The comment is acknowledged; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

ENGINEERS + GEOLOGISTS + ENVIRONMENTAL SCIENTISTS

SOLID AS A ROCK

COMMENT LETTER P44

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Dr. Siamak Jafroudi, President
Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626

Date: March 23, 2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P44-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

Dr. Siamak Jafroudi
President

SJ/lv

P44. RESPONSES TO COMMENTS FROM SIAMAK JAFROUDI, MARCH 23, 2020.

P44-1 The commenter generally supports the proposed project, specifically the introduction of housing, jobs, and multimodal improvements in Costa Mesa. The commenter also supports locating residential and employment centers in close proximity to one another to reduce long commutes and vehicle miles traveled. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

To: Ms. Minoo Ashabi, Principal Planner
City of Costa Mesa
Planning Division
77 Fair Drive
Costa Mesa, CA 92626

From: Russell Yarwood

Date: Friday, March 20, 2020

Subject: One Metro West EIR, Specific Plan, and Master Plan

Dear Ms. Ashabi,

We have had an opportunity to review the One Metro West EIR, Specific Plan, and Master Plan and feel strongly that this is the right project in the right location at the right time for our city. We need more housing in Costa Mesa for the present and future employers of the regional, national, and international companies moving into the city.

P45-1

The new multi-model opportunities of today and the future in close proximity to employment and residential centers will reduce long commutes on freeways and therefore improve traffic. This project represents a giant leap forward in making the City of Costa Mesa more livable.

Sincerely,

Russell Yarwood
2439 Orange Ave.
(949) 326-3627
russell@yarwood.in

P45. RESPONSES TO COMMENTS FROM RUSSELL YARWOOD, MARCH 20, 2020.

P45-1 The commenter generally supports the proposed project, specifically the introduction of housing and jobs in Costa Mesa. The commenter also supports locating residential and employment centers in close proximity to one another to reduce long commutes and associated traffic congestion. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Laurel Golden <laurelgolden@sbcglobal.net>
Sent: Thursday, March 26, 2020 5:01 PM
To: OMW Public Comments
Subject: One Metro West

Dear Sirs and Madams:

I am strongly opposed to the One Metro West development and urge "no project". I feel it is out of character for this area of Costa Mesa and will negatively affect current residents. My reasons are as follows;
• If approved, it will set a precedent for building more population-dense projects in Costa Mesa • It will be 98 feet tall and seven stories, more than 3 times the current building height of 31 feet • The tallest buildings in the city are currently clustered around Bristol and one on 17th Street • There will be 1057 rental units with an anticipated 2886 residents and employees • It will account for more than 50% of the coming population growth in Costa Mesa • They are expecting an additional 6800 daily car trips from the current 429 • The new trips will negatively impact the streets and freeways • Air quality will be negatively impacted during construction and with the increased car trips when residents move in • The plan to have light reflecting off the buildings at night • Mesa Verde neighborhoods will again bear the brunt of construction • There are no drawings in the EIR that show a view of the height of the buildings from Mesa Verde but it will probably obscure our view of the mountains After reading, I urge a “no project” response. P46-1

Thank you,
Laurel Golden
3262 Washington Ave.
Costa Mesa, CA 92626

P46. RESPONSES TO COMMENTS FROM LAUREL GOLDEN, MARCH 26, 2020 AND MARCH 29, 2020.

P46-1 The commenter generally opposes the proposed project and lists several reasons, including the following: setting a precedent for more population-dense projects in Costa Mesa; developing buildings substantially taller than the existing 31-foot industrial building; introducing 1,057 rental units with up to 2,886 residents and employees; generating more than 50 percent of the City's forecasted population growth; generating approximately 6,800 net average daily trips that would negatively impact nearby roadways and the I-405 Freeway; impacting air quality during project construction and operations; creating lighting impacts associated with the proposed parking garage façade; generating construction-related impacts on the Mesa Verde neighborhoods; and obstructing views towards the mountains from the Mesa Verde neighborhoods.

The Draft EIR analyzes the project's potential to impact all of the identified issue areas, including creating a precedent-setting action (refer to pages 10-3 through 10-4 of Chapter 10, *Growth-Inducing Impacts of the Proposed Project*); aesthetic impacts related to increased building heights, lighting, and obstruction of public views (refer to pages 5.1-10 through 5.1-28 of Section 5.1, *Aesthetics*); population, housing, and employment impacts (refer to pages 5.11-7 through 5.11-10 of Section 5.11, *Population and Housing*); transportation impacts (refer to pages 5.13-23 through 5.13-45 of Section 5.13, *Transportation*); and construction and operational air quality impacts (refer to pages 5.2-21 through 5.2-31 of Section 5.2, *Air Quality*). Additionally, construction-related impacts associated with various environmental topical areas are discussed where applicable in the Draft EIR. This comment does not specifically relate to the adequacy of the Draft EIR analysis and thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

P46-2 Refer to response to comment P46-1.

From: EBG <elizgrant@yahoo.com>
Sent: Thursday, March 26, 2020 7:52 PM
To: OMW Public Comments
Subject: Re: 1683 Sunflower

To:
OMWPublicComments@costamesa.gov

The proposed building of three 7-story apartment buildings at 1683 Sunflower will have a huge and NEGATIVE IMPACT on traffic, air quality, and overall density in North Costa Mesa, including the Harbor, Fairview, and Susan Street freeway exits. I do not think this is good for our current residents. Please do not approve this massive project. P47-1

Elizabeth B. Grant
1360 Watson Ave.
Costa Mesa, CA 92626

EBG

P47. RESPONSES TO COMMENTS FROM ELIZABETH GRANT, MARCH 26, 2020.

P47-1 The commenter generally opposes the project, stating that the proposed development would have a large, negative impact on traffic, air quality, and overall density in north Costa Mesa, including the Harbor Boulevard, Fairview Road, and Susan Street exits off the I-405 Freeway. The project's potential impacts related to traffic, air quality, and density are analyzed and compared to CEQA thresholds of significance in Sections 5.13, *Transportation*, 5.2, *Air Quality*, and 5.9, *Land Use*, in the Draft EIR. The Draft EIR acknowledges significant and unavoidable impacts related to traffic along select roadways and freeway ramps/segments and construction-related air quality emissions. This comment does not specifically relate to the adequacy of the Draft EIR analysis and thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P48

From: Rita Popp <wingsnbeak@gmail.com>
Sent: Friday, March 27, 2020 10:19 AM
To: OMW Public Comments
Subject: NO project

I am very against the One Metro West project.

We already have too much congestion. P48-1

NO PROJECT

Rita Popp

2078 Goldeneye Pl, Costa Mesa, CA 92626

P48. RESPONSES TO COMMENTS FROM RITA POPP, MARCH 27, 2020.

P48-1 The commenter generally opposes the project stating that the City already has too much congestion. The comment does not specifically address the adequacy of the Draft EIR analysis; as such, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Bill "SurfcityBilly" Partnoff [mailto:Billy@surfcitybilly.com]
Sent: Friday, March 27, 2020 3:03 PM
To: OMW Public Comments <OMWPublicComments@costamesaca.gov>
Subject: No on ONE METRO WEST Project Please

Please voted "NO" for ONE METRO WEST development!

Look at what people are saying about their properties in Irvine. Is that what you want for Costa Mesa?

Here is also Reviews for the Rose Equities Properties in Irvine that I posted on Next Door News Mesa Verde

In case you might start to believe some of the glossy literature and PR spin Rose Equities is putting out there about their One Metro West... look at their latest similar apartment developments in Irvine.. "Elements" "Metropolis". These developments have a dismal 3 & 3-1/2 Google star reviews from their renters based on the developers poor construction and materials, design, parking, noise and management problems...from the onset to a few weeks ago. If the City of Irvine could not secure a quality development that is an asset to their community why does Costa Mesa think we can!? What renter is going to remain and invest in the community when the project's developer, Rose Equities, performance history is so poor? Their "Walk ability" claim.. little/no traffic will be generated??? Unless the lease requires a clause to insure that the renters have limited vehicle mobility.... impossible to enforce or claim! Be sure that the "powers that be " are counting on your lack of participation and are promising the developer that One Metro West can be pushed thru, past the citizens of Costa Mesa. E-mail the City Council today to voice your concerns and opposition to One Metro West high rise, high density development. Share with a neighbor whom might not be aware! P49-1

Also MVCI Board's opposition to this project is attached.

--
Take Care,

Bill "SurfcityBilly" Partnoff
Broker BRE# 01202846
(714) 271-2647
www.surfcitybilly.com
SurfcityBilly.com...Leading You into the Future of Real Estate

P49. RESPONSES TO COMMENTS FROM BILL PARTNOFF, MARCH 27, 2020.

P49-1 The commenter generally opposes the project and raises concerns regarding the quality, design, noise, and management issues of other Rose Equities developments in the City of Irvine. The commenter also states that the Draft EIR states little to no traffic would be generated by the proposed project. This is incorrect; as detailed in Section 5.13, *Transportation*, of the Draft EIR, the project would generate approximately 6,800 net average daily trips, including 498 net trips in the a.m. peak hour and 662 net trips in the p.m. peak hour. Based on the anticipated project trips, the Draft EIR acknowledges that the project would result in significant and unavoidable transportation impacts at two study area intersections and several freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios.

The commenter also references the Mesa Verde Community Inc. comment letter included as Comment Letter O2 in this Final EIR. This comment does not identify a specific concern with the adequacy of the Draft EIR or raise an issue or comment specifically related to the Draft EIR analysis. Refer to responses to Comment Letter O2 above. No further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Duane and Diane Smith <twodsmiths@socal.rr.com>
Sent: Saturday, March 28, 2020 6:24 AM
To: OMW Public Comments
Subject: One Metro West

NO!
A concerned Costa Mesa resident.
Sent from my iPad

P50-1

P50. RESPONSES TO COMMENTS FROM DUANE SMITH, MARCH 28, 2020.

P50-1 The commenter generally opposes the project. This comment is not related to the adequacy of the Draft EIR analysis; no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P51

From: TAMARA BERARDI <tiggett@aol.com>
Sent: Saturday, March 28, 2020 12:24 AM
To: OMW Public Comments
Subject: One Metro West

I am strongly opposed to the project One Metro West for a multitude of reasons. The traffic impact will be both negative and https://linkprotect.cudasvc.com/url?a=https%3a%2f%2fmassive.it&c=E,1,RWAUZx5ce3xVSm0Y7jLH4XYDjA3btTfnI2BwoYbQ3JrW2dBclGeq8kKWAhrMj4ht8FrUjWlo62tkWx9B63WQe02TNQx7UVdLzGLAoWl8m8V1zlfXwAbIjx3B0GQ,&typo=1 is already very crowded during morning and evening rush hours on that stretch of Harbor Blvd. It is a gigantic project, one that will dwarf anything else in the area. That many people and cars will have a negative effect on the environment, the neighbors, the roadways and the emergency agencies. I urge you to reject this project! P51-1

Sincerely,
Tamara Berardi
714-964-9913

Sent from my iPad

P51. RESPONSES TO COMMENTS FROM TAMARA BERARDI, MARCH 28, 2020.

P51-1 The commenter generally opposes the project stating that traffic along Harbor Boulevard is already too congested during morning and evening rush hours and that project-generated residents and vehicle trips would adversely impact the environment, neighbors, roadways, and emergency agencies. The Draft EIR analyzes the project's potential impacts related to each of these issues, including the natural environment (Chapter 8, *Impacts Found Not to Be Significant*), neighbors and land use compatibility (Section 5.11, *Population and Housing*), traffic and roadway congestion (Section 5.13, *Transportation*), and emergency services (Section 5.12, *Public Services*). These comments are not specifically related to the adequacy of the Draft EIR analysis and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Jason Thesing <jasonthesing@yahoo.com>
Sent: Friday, March 27, 2020 9:58 PM
To: ASHABI, MINOO
Subject: One metro west

No on this project
This is a big NO!!!
from me and my neighbors in the Mesa Verde neighborhood

The EIR shows this thing would be a disaster for the traffic in Costa Mesa on harbor especially

We will all suffer the pollution from more people, more cars, more trash, more congestion, overcrowding construction pollution and noise

P52-1

Also I want to see a visual and perspective head on of what the 108 ft towers will look like from different streets in Mesa verde like Iowa, California, Gisler, Country club, Mesa verde loop area. Adams ave. Harbor, etc...

This thing is Way to big and utterly obnoxious and shouldn't even be considered.

P52-2

-Jason

Sent from my iPhone

From: Jason Thesing <jasonthesing@yahoo.com>
Sent: Sunday, March 29, 2020 10:10 PM
To: citycouncil@costamesaca.gov
Subject: One Metro West project.

To whom it may concern,

I understand that under the new rules concerning public attending public hearings regarding the disastrous potential project " One metro west " we the public will not be able to voice our opinion and strong opposition to this project and that the council will be meeting behind closed doors without public input from the project. This is not acceptable. I think that we can practice social distancing and abide by all the necessary rules proposed by the city. If we can not do this, the hearings need to be canceled and rescheduled for after this thing ends. We don't care that the developer wants to push this thing through and rubber stamp this project. Doing this does the people of Costa Mesa a huge disservice and and is shady and completely wrong.

P52-3

We must if needed suspended all public hearings and anything else that pertains to this project till after we are out of the crisis

Thank you,

Jason Thesing
Costa Mesa resident sense 1991

P52. RESPONSES TO COMMENTS FROM JASON THESING, MARCH 27, 2020 AND MARCH 29, 2020.

P52-1 The commenter raises general concerns regarding the project's impacts from the anticipated increase in population, vehicles and traffic congestion, solid waste, construction-related air pollution, and noise. The Draft EIR analyzes the project's potential impacts related to each of these issues, including population (Section 5.11, *Population and Housing*), traffic congestion (Section 5.13, *Transportation*), solid waste (Section 5.15, *Utilities and Service Systems*), construction-related air quality emissions (Section 5.2, *Air Quality*), and noise (Section 5.10, *Noise*).

P52-2 The commenter requests renderings of the project from different roadways in the Mesa Verde neighborhood. According to the Specific Plan and Master Plan, Building A would have a maximum building height of six stories; Buildings B and C would have maximum building heights of seven stories; and the Creative Office Building would have a maximum building height of three stories. As detailed in Draft EIR Section 5.1, *Aesthetics*, the City's physical setting allows for views of scenic resources including the Pacific Ocean, Santa Ana River, Upper Newport Bay, and Santa Ana Mountains. Views of these resources are afforded at specific public locations within the City that provide uninterrupted, large expanse views of undeveloped land and these resources. According to the General Plan EIR, such locations include Fairview Park, Talbert Regional Park and its adjacent wildlife refuge, and the golf courses, parks, and ballfields in the City. These specific locations do not include views of the project site. Therefore, public scenic views looking north from neighborhoods south of the I-405 Freeway towards the Santa Ana Mountains would not be significantly impacted by the project. It should also be noted that private views from residences are not specifically protected under CEQA, but rather under the threshold pertaining to consistency with regulations governing scenic quality. As discussed in response to comment O2-2, per Draft EIR Table 5.1-1, *Project Consistency with the Costa Mesa General Plan*, the proposed project would be consistent with relevant General Plan goals, objectives, and policies pertaining to scenic quality (including consideration of proposed building heights as applicable). However, this comment regarding visual impacts from private views is acknowledged and has been provided to the City's decisionmakers for consideration.

P52-3 In light of COVID-19, the commenter is concerned that the City has converted public hearings into private meetings behind closed doors without public input and that the project would be approved without any public participation. The commenter requests all public hearings be suspended until COVID-19 is under control and the social distancing requirement is lifted.

At this time, while City Hall is generally closed to the public, the Costa Mesa City Council and Planning Commission meetings are being conducted in compliance with the Brown Act as modified by the Governor's COVID-19 emergency orders. The City Council and Planning Commission meetings are currently being conducted via conference call, streamed via YouTube, and on the City's local television channel, and continue to allow for and encourage public participation. The specific methods of accessing meetings are posted on the Planning Commission and City Council agendas 72 hours in advance of each regular meeting. As part of the public hearing process, the City invites public hearing comments through various methods, including, but not limited to, the following:

- Emails to the City Clerk (for Planning Commission meetings via pcpubliccomments@costamesaca.gov and for City Council meetings via cityclerk@costamesaca.gov);
- Emails are accepted continuously during meetings and will be read into the record by City Clerk staff during the comment portion applicable to the specific item;
- Comments via voice message so a comment can be transcribed and included into the record if the commenter does not have email capability; and/or
- Hardcopy comments may be submitted to the City Clerk at City Hall.

In addition, further public engagement options, including video conference "Zoom" meetings are planned for future meetings.

From: bobkeyes3 <bobkeyes3@yahoo.com>
Sent: Friday, March 27, 2020 9:14 PM
To: OMW Public Comments
Subject: One metro west

Please, please do not approve this project. It is incompatible with the neighborhood opposite the freeway.
The traffic is already a mess at the Harbor Blvd on/off ramps.
Please read the reviews that residents of Rose Properties projects in Irvine - Elements & Metropolis - have received regarding the shoddy craftmanship of their apartments.
We don't need this in our city, P53-1

Sent from my Galaxy Tab A

P53. RESPONSES TO COMMENTS FROM BOB KEYES, MARCH 27, 2020.

P53-1 The commenter states that the project is incompatible with the Mesa Verde neighborhood south of the I-405 Freeway and would exacerbate existing traffic congestion at the I-405 Freeway Harbor Boulevard on- and off-ramps. The Draft EIR considered the project's proximity to the Mesa Verde neighborhood for all topical areas, as appropriate. Additionally, the Draft EIR acknowledges that the project would result in significant and unavoidable transportation impacts at two study area intersections and several freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios; refer to Section 5.13, *Transportation*, of the Draft EIR.

The commenter also raises concerns regarding negative reviews from existing residents of other Rose Equities developments in the City of Irvine. This comment is not related to the project's environmental impacts or adequacy of the Draft EIR analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P54

From: Erik Schuman <erikschuman@yahoo.com>
Sent: Friday, March 27, 2020 7:39 PM
To: OMW Public Comments
Subject: One Metro West Project

To the City of Costa Mesa,

This email is about the aforementioned: One Metro West project.

This is not a bad idea. IT IS A HORRIBLE IDEA!

This high density project does nothing but make a bad traffic situation even worse. It will be a big time ugly eyesore to not only the City but to the surrounding area. The environmental impact of this project will not only destroy Costa Mesa but once again....surrounding areas. It will also do nothing to help low income housing. P54-1

DON'T be Fountain Valley! The City Council there agreed to the "FV Crossings" project that will not be all that far away and will "compete" with this one (if approved - and let's be honest here - the CMCC already has your mind made up to approve this) for the biggest eyesore and worst idea in the area.

YOU ARE BETTER THAN THIS! Hopefully. Do the right thing and DO NOT approve this project

Erik Schuman
714-745-3745

P54. RESPONSES TO COMMENTS FROM ERIK SCHUMAN, MARCH 27, 2020.

P54-1 The commenter opposes the project stating that it would increase traffic congestion and adversely impact the visual quality of the project area, similar to the FV Crossing project in the City of Fountain Valley. The commenter also states that the project would do nothing to help low income housing. These comments are not related to the adequacy of the Draft EIR analysis. Notwithstanding, it is acknowledged that the Draft EIR considers the project's impacts on traffic and aesthetics, as evaluated in Section 5.13, *Transportation*, and Section 5.1, *Aesthetics*, of the Draft EIR, respectively. The project would also provide, at a minimum, 105 of the 1,057 proposed units as affordable housing units, thereby contributing towards the City's Regional Housing Needs Allocation and providing affordable housing within Costa Mesa. This comment is acknowledged and has been provided to City decision makers for consideration.

COMMENT LETTER P55

From: Ken Rhea <kjrhea@gmail.com>
Sent: Saturday, March 28, 2020 11:45 AM
To: OMW Public Comments
Subject: NO NO NO

To whom it may concern:

I've lived in the State Streets for 25 years. Please don't put this development in front of me.

Please do some personal investigation. When the physical distancing lifts get in your car and drive around the proposed site at peak traffic times. You won't need the EIR traffic report.

A seven-story facade will be awful. There will be no way to pretty it up. I imagine it will be like looking at OCJ from the civic center. Do the plans show anything architecturally pleasing?

P55-1

What will the range of affordable housing be? It will not be low income. I do not remember the price range of the apartments but the cost of the development will necessitate rents commensurate with Huntington Beach, Newport Beach, and Irvine. Rents will not compare with Midway City, Stanton, and Buena Park. How many people will need to occupy a unit in order to make it affordable? Have the extra vehicles been programmed into the equation? WIll there be a vehicle limit per unit?

The Rose Equities developments in Irvine have not garnered good reviews.

I think our city has listened well to Rose. Now it's time to listen to our citizens. P55-1 cont'd

NO NO NO

Best regards,

Kenneth J. Rhea, MFT 14233

(714) 775-0777
Office: 16152 Beach Blvd
Huntington Beach, CA 92647
Mailing: 2973 Harbor Blvd. Suite 292
Costa Mesa, CA 92626

P55. RESPONSES TO COMMENTS FROM KENNETH RHEA, MARCH 28, 2020.

P55-1 The commenter opposes the proposed project due to the project's potential impacts on traffic congestion and aesthetics. The project's impacts on traffic and aesthetics are evaluated in Section 5.13, *Transportation*, and Section 5.1, *Aesthetics*, of the Draft EIR, respectively. Specifically, the Draft EIR acknowledges that the project would result in significant and unavoidable transportation impacts in regard to non-residential VMT and at two study area intersections and several freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios. Further, it should be noted that private views, as seen from the Mesa Verde neighborhood are not public scenic vistas. Pursuant to the CEQA Guidelines, in urbanized areas, consideration of the project's potential to conflict with applicable zoning and other regulations governing scenic quality were considered, including the proposed parking garage façade. As detailed in Draft EIR Section 5.1, *Aesthetics*, Impact 5.1-1, Operations, the proposed Specific Plan's design and development standards would regulate the design of the parking garage façade. As detailed in Draft EIR Table 5.1-1, *Project Consistency with the Costa Mesa General Plan*, the proposed project would be consistent with relevant General Plan goals, objectives, and policies pertaining to scenic quality (including consideration of the proposed parking garage façade). Overall, impacts regarding the potential to conflict with applicable zoning and other regulations governing scenic quality were determined to be less than significant.

The commenter also questions how much the affordable housing units would cost, whether a certain number of people need to occupy the unit to make it affordable, or if there will be a vehicle limit per unit. Although not a CEQA issue, a minimum of 105 affordable units would be provided at varying affordability levels based on qualifying income levels. The affordable housing terms and conditions would be included in the project's Development Agreement. The cost of providing affordable housing units is not a CEQA issue. Additionally, the commenter raises concerns regarding negative reviews on other Rose Equities developments in the City of Irvine. These comments are not related to the project's environmental impacts or adequacy of the Draft EIR analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P56

From: John Brown <john_brown@pacbell.net>
Sent: Sunday, March 29, 2020 12:10 AM
To: OMW Public Comments
Subject: Metro One

Please do not allow the metro one project to go forward. We already have a tremendous amount of traffic in the area. The major streets around there are highly congested, especially at rush hours. P56-1

Please vote no on the project.

John Brown
3334 Nevada Ave
Costa Mesa, CA
92626

P56. RESPONSES TO COMMENTS FROM JOHN BROWN, MARCH 29, 2020.

P56-1 The commenter opposes the project stating that there is already too much traffic in the project area. This comment is not related to the adequacy of the Draft EIR analysis. The project's traffic impacts are evaluated in Section 5.13, *Transportation*, of the Draft EIR, which concludes that the project would result in significant and unavoidable transportation impacts in regard to non-residential VMT and at two study area intersections and several freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios.

From: Lisa Lacey <lisa.herl.lacey@gmail.com>
Sent: Sunday, March 29, 2020 9:42 AM
To: OMW Public Comments
Subject: Apartments

Please!! Do not build this. I strongly feel that infrastructure should be in place BEFORE building. Widen streets FIRST. The impact on traffic and the lives of the citizens will be horrific!! P57-1

Sent from my iPhone

From: Lisa Lacey <lisa.herl.lacey@gmail.com>
Sent: Sunday, March 29, 2020 9:49 AM
To: OMW Public Comments
Subject: One Metro West

I say NO!! The impact on residents will be terrible.
You are trying to turn our city into New York City!!
Your beautiful buildings are just high end Projects (as in inner city). Look at the area by Trader Joe's in Costa Mesa. P57-2
Traffic is a NIGHTMARE!!
NO!!!

Sent from my iPhone

P57. RESPONSES TO COMMENTS FROM LISA LACEY, MARCH 29, 2020.

P57-1 The commenter opposes the project and states that required infrastructure improvements (e.g., widening of roadways) should be in place before a proposed development is constructed. As detailed in Section 5.13, *Transportation*, of the Draft EIR, Mitigation Measure T-1 would require the project applicant to contribute its fair share contribution to the City of Costa Mesa Transportation Division for the implementation of adding a southbound right-turn lane by restriping Susan Street at the intersection Susan Street/South Coast Drive (Study Intersection No. 18), and Mitigation Measure T-2 requires the project applicant to contribute its fair share contribution to the City of Fountain Valley Transportation Division for improvements to the intersection of Talbert Avenue/Mt. Washington Street (Study Intersection No. 28), including adding a traffic signal, restriping the northbound approach to a shared left through lane and a dedicated right turn lane, converting the southbound right turn lane to a dedicated channelized free right turn lane, and adding overlap phasing for a northbound right turn movement. These mitigation measures are required to be implemented prior to the issuance of the first building permit. Thus, the required fair share contributions would occur prior to the start of construction activities. Fair share contributions are adequate mitigation for CEQA purposes; however, it should be noted that the fair share contributions required under Mitigation Measure T-1 and T-2 do not result in construction of the improvements at Study Intersection No. 18 and No. 28 until the improvements are fully funded and identified in each respective jurisdiction's capital improvement plan. As such, despite recommended mitigation measures that would reduce these impacts to less than significant levels, these impacts remain significant and unavoidable; refer to Draft EIR Chapter 6, *Significant Unavoidable Adverse Impacts*. The City of Costa Mesa would be required to make a Statement of Overriding Considerations pertaining to the project's significant and unavoidable transportation impacts in order to approve the proposed project.

P57-2 The commenter opposes the project stating that the project would convert Costa Mesa into New York City. This comment is not related to the adequacy of the Draft EIR analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P58

From: Karla P. Stagman <karlastagman@mac.com>
Sent: Sunday, March 29, 2020 10:19 AM
To: OMW Public Comments
Subject: One Metro West- against

I'm concerned about the scale and environmental impact. We already have too much traffic. Our roads are packed. I am against this proposal. P58-1

Thank you,

KARLA P. STAGMAN
REALTOR I CAL DRE 01984094
949.294.5794
KarlaStagman@mac.com

P58. RESPONSES TO COMMENTS FROM KARLA STAGMAN, MARCH 29, 2020.

P58-1 The commenter opposes the project stating that there is already too much traffic in the project area. This comment is not related to the adequacy of the Draft EIR analysis. However, the project's traffic impacts are evaluated in Section 5.13, *Transportation*, of the Draft EIR, which concludes that the project would result in significant and unavoidable transportation impacts in regard to non-residential VMT and at two study area intersections and several freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios.

COMMENT LETTER P59

From: Raymond Polverini <raymond.polverini@gmail.com>
Sent: Sunday, March 29, 2020 10:31 AM
To: OMW Public Comments
Subject: One Metro West

I am in favor of the project. It's scope and scale are appropriate for the site. P59-1

Raymond Polverini
2023 GOLDENEYE PLACE
COSTA MESA, CA 92626

P59. RESPONSES TO COMMENTS FROM RAYMOND POLVERINI, MARCH 29, 2020.

P59-1 The commenter generally supports the project stating that its scope and scale are appropriate for the site. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P60

From: Marsha Shafer <peimarsha@yahoo.com>
Sent: Sunday, March 29, 2020 11:56 AM
To: OMW Public Comments; ASHABI, MINOO
Subject: RE: ONE METRO WEST

NO PROJECT! P60-1

P60. RESPONSES TO COMMENTS FROM MARSHA SHAFER, MARCH 29, 2020.

P60-1 The commenter opposes the project and does not provide any specific comments related to the project's environmental impacts or adequacy of the Draft EIR analysis. As such, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P61

From: Johnal Leifsson <johnal.leifsson@gmail.com>
Sent: Friday, March 27, 2020 5:39 PM
To: OMW Public Comments
Subject: Against proposed project

As a longtime resident of Costa Mesa, and this proposed project is not sound appealing in that the advantages do not outweigh the disadvantages brought forth by it. P61-1

Johnal Leifsson
1250 Londonderry st
Costa Mesa, CA 92626

P61. RESPONSES TO COMMENTS FROM JOHNAL LEIFSSON, MARCH 27, 2020.

P61-1 The commenter states that the project's pros do not outweigh its cons. This comment is not related to the project's environmental impacts or adequacy of the Draft EIR analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Bob Hagerty <bobceci@sbcglobal.net>
Sent: Sunday, March 29, 2020 10:42 PM
To: OMW Public Comments
Subject: Re: One Metro West - NO PROJECT / NO DEVELOPMENT ALTERNATIVE

C.M.C.C.,

After careful review and consideration, it is my position that the One Metro West project be rejected. To be clear I vote NO.

After reviewing other projects from this group, it is apparent that they will not meet the needs or standards of the Mesa Verde area in Costa Mesa. These developments have dismal reviews from their renters, based on the developer's poor construction and materials, design, parking, noise and management problems

There are several issues with this proposal including the impacts this project will have to our community and the Costa Mesa General Plan. P62-1

- AESTHETICS
- ZONING
- AIR QUALITY
- INCREASED TRAFFIC
- GREENHOUSE GAS EMISSIONS

OPEN SPACE
Please opt for the NO PROJECT / NO DEVELOPMENT ALTERNATIVE.   Costa Mesa deserves better that this. P62-1 cont'd

Regards,
Bob Hagerty
Costa Mesa Resident

P62. RESPONSES TO COMMENTS FROM BOB HAGERTY, MARCH 29, 2020.

P62-1 The commenter opposes the project and lists several environmental topical areas that would be adversely impacted by the project. The commenter also raises concerns regarding negative reviews from existing residents of other Rose Equities developments. These comments do not raise specific issues with the adequacy of the Draft EIR analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Peggy Partnoff <peggypartnoff@yahoo.com>
Sent: Monday, March 30, 2020 9:21 AM
To: CITY COUNCIL; FOLEY, KATRINA; STEPHENS, JOHN; GENIS, SANDRA; MANSOOR, ALLAN; MARR, ANDREA; REYNOLDS, ARLIS; ASHABI, MINOO; CHAVEZ, MANUEL
Subject: Public Access at Council Meetings

I am contacting all City Council members to strongly urge you to postpone any voting on the proposed One Metro West project until sessions can be assembled as legitimate public meetings. Due to the Covid-19 pandemic the citizens of Costa Mesa are certainly preoccupied with urgent health matters and cannot devote the necessary attention to this development proposition. It would be a travesty to proceed with a vote on such a major development in the City of Costa Mesa without proper public accessibility. Any council vote during these times would taint the voting outcome and cause considerable suspicions on the integrity of those City members participating in a unnecessarily rushed process. And the idea of adding 1,060 apartment units with an unknown number of occupants to a current health pandemic is unfathomable, when unnecessary.
The developer, Rose Equities, surely understands the unprecedented circumstances our society is experiencing at this time and can forestall their profit expectations from the City of Costa Mesa.

P63-1

Respectfully,
Peggy Partnoff

3321 Alabama Circle, CM 92626
714-330-9917

P63. RESPONSES TO COMMENTS FROM PEGGY PARTNOFF, MARCH 30, 2020.

P63-1 Refer to response to comment P52-3 pertaining to public hearings during the COVID-19 pandemic. The commenter also states that the proposed 1,057 units with an unknown number of occupants would be introduced into the City during the COVID-19 health pandemic. Based on the City's average household size of 2.73 residents per dwelling unit, the project would introduce up to 2,886 residents; refer to Draft EIR Section 5.11, *Population and Housing*. It should also be noted that project construction would take approximately five years to complete with first occupancy anticipated in 2027.

COMMENT LETTER P64

From: Alyssa Thesing <anclark37@hotmail.com>
Sent: Monday, March 30, 2020 10:01 AM
To: OMW Public Comments
Subject: one metro west

NO PROJECT! This project will not be good for the future of Costa Mesa. P64-1

P64. RESPONSES TO COMMENTS FROM ALYSSA THESING, MARCH 30, 2020.

P64-1 The commenter opposes the project and does not provide any specific comments related to the project's environmental impacts or adequacy of the Draft EIR analysis. No further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

COMMENT LETTER P65

From: Athena Balistreri <leftyinca@gmail.com>
Sent: Monday, March 30, 2020 11:29 AM
To: OMW Public Comments
Subject: One Metro Comment in support

As a nearby resident to the One Metro site, I am actually in favor of this project. I live in the spice streets of north Mesa Verde and think this project would give greater flexibility and opportunity for people to work and live around the same place. With the Press nearby and an expansion of the Vans headquarters happening now, work and live spaces could easily go hand in hand. I do not believe the visual impact of this project will be as dire as some out there are trying to portray it to be. There are codes and regulations that will force this project to comply with lighting standards, parking standards, open space, height restrictions, and so many other things. The grade height of the site and the height in relationship to the freeway will actually visually hide a few levels of this project, even further reducing the conceived height of this building both from the freeways as well as any view corridors that may occur from the state street neighborhood. Having personally frequented Moon Park and other regions of the state streets by walking public sidewalks I never saw any visual connection with the north side of the 405 either because it was being blocked by foliage and trees or by the sound wall that runs along the 405 itself. P65-1

What we need right now is housing, housing that will give an opportunity to saturate the housing/ rental market with the potential to create a more fairly valued market. The location of this project would not greatly impact the state streets as some have suggested because the state streets are largely a dead-end for transportation. If potential future residents of Metro One were looking for grocery and shopping options they could easily head down sunflower toward South Coast Plaza where there are ample shopping opportunities. Also easily reachable are the things toward Fountain Valley, and north Costa Mesa with Target and other restaurant opportunities there. These locations I personally already inhabit for my shopping and retail needs, and this would not be any different in my opinion. With this project also being adjacent to the river biking trail it would actually give ample opportunity for people to bike instead of drive to locations, which is even better.

P65-1 cont'd

Overall I support this project and would like to see it continue through to approval and construction/

Thank You,
Athena B.
Coriander Drive Resident

P65. RESPONSES TO COMMENTS FROM ATHENA BALISTRERI, MARCH 30, 2020.

P65-1 The commenter supports the project, including the introduction of more live-work developments in Costa Mesa. The commenter states that concerns regarding aesthetic, building height, and traffic impacts on the Mesa Verde neighborhood are not as substantial as some are trying to portray given that the project would be required to comply with a number of proposed development standards and regulations regarding lighting, parking, open space, and building height, among others. Additionally, the existing site elevation in relation to the I-405 Freeway would partially obstruct a few levels of the proposed structures, further reducing the perceived height of the structures both from the I-405 Freeway as well as any view corridors to the south. Existing views looking towards the site from Moon Park and Mesa Verde neighborhood sidewalks are also partially obstructed by existing foliage, trees, and the sound wall along the I-405 Freeway. This comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Mike Chun (Dorene Takenaka) <mchun@watg.com>
Sent: Monday, March 30, 2020 11:35 AM
To: OMW Public Comments
Subject: Objection to ONE METRO WEST Development

Costa Mesa City Council:

As a retired architect and urban planner, as well as a 40 year resident of Costa Mesa (1803 Tanager Drive, Costa Mesa, Ca) I object to the ONE METRO WEST Development Application. It is my opinion the density and location of the proposed development is inconsistent with sound planning practices.

P66-1

If you would like further clarification on my objection or to discuss further please feel free to contact me by email or phone at 714.662.3397.

Regards,

Michael Chun

Michael M.S. Chun, Chairman Emeritus
WATG | designing destinations
8001 Irvine Center Drive, Suite 500 | Irvine, CA 92618 USA

+1 949 574 8500 tel
watg.com

P66. RESPONSES TO COMMENTS FROM MICHAEL CHUN, MARCH 30, 2020.

P66-1 The commenter states that the project's density and location is inconsistent with sound planning practices. No specific comment related to the adequacy of the Draft EIR analysis is provided. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: bobbriq@gmail.com <bobbriq@gmail.com>
Sent: Monday, March 30, 2020 1:49 PM
To: ASHABI, MINOO
Subject: One Metro West opposition

As a resident of Costa Mesa, my wife and I oppose the new One Metro West project being considered for our city. Our traffic is already compromised, and the additional residence and commercial traffic will only add to it. P67-1

Sincerely,
Robert & Jeannise
Bernal

Bob Bernal
(714) 863-2140
briq07@att.net

P67. RESPONSES TO COMMENTS FROM BOB BERNAL, MARCH 30, 2020.

P67-1 The commenter opposes the project stating that there is already too much traffic in the project area. The commenter does not specifically question the adequacy of the Draft EIR analysis. Refer to Draft EIR Section 5.13, *Transportation*, for a full evaluation of the project's traffic impacts. As such, no further response is required as part of the CEQA process/CEQA response to comments.

From: Ryan Maloney [mailto:ryan.maloney@gmail.com]
Sent: Sunday, March 29, 2020 8:37 PM
To: OMW Public Comments <OMWPublicComments@costamesaca.gov>; ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: Public Comment on One Metro West

To Whom It May Concern,

I would like to voice my opposition to the proposed One Metro West project. While I believe that California needs to do more to provide housing, I feel overall impacts of this project would be detrimental to the local community. It's a massively over-sized project in an area with already severe traffic, parking and accessibility issues. P68-1

Thank you.

Sincerely,
Ryan Maloney
Fountain Valley, CA

P68. RESPONSES TO COMMENTS FROM RYAN MALONEY, MARCH 29, 2020.

P68-1 The commenter acknowledges the need for more housing in California but opposes the project due to its size and impacts on traffic, parking, and accessibility. These comments are not specifically related to the adequacy of the Draft EIR analysis. The project's impacts on traffic and accessibility are evaluated in Section 5.13, *Transportation*, of the Draft EIR. Parking is not an environmental issue under CEQA; however, the project would provide surface parking lots and parking garages on-site as well as parallel parking along the southern side of Sunflower Avenue. As detailed in Draft EIR Chapter 3, *Project Description*, and in the Specific Plan, parking would be provided at a ratio of 1.3 spaces per dwelling unit and 4 spaces per 1,000 square feet for non-residential development. In total, the project would provide 1,914 spaces on-site with additional parallel parking available off-site along the southern side of Sunflower Avenue. In addition to designated single and tandem parking spaces for residents and their guests, the Building A parking garage would provide shared spaces for residential and office parking and the Building C parking garage would also provide spaces assigned to the retail uses on-site. No parking spaces would be assigned exclusively for the public use of the open space other than required accessible spaces; however, street parking would be available along Sunflower Avenue.

SANDRA GENIS
1586 MYRTLEWOOD **COSTA MESA, CA. 92626**

March 30, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa
Development Services Department
77 Fair Drive
Costa Mesa, CA 92626

Attn: One Metro West Draft EIR, SCH 2019050014

Below are my comments on the Draft Environmental Impact Report (DEIR) for for the One Metro West project (SCH 2019050014) in the City of Costa Mesa in Orange County. The proposed mixed use project is located on a 15.2 acre site at 1683 Sunflower Avenue.

The proposed development includes 1,057 dwellings, 25,000 sq. ft. of office space, and 6,000 sq. ft. of retail. Also included is 1.5 acres of open space and modification of an existing bike trail. P69-1

Thank you for extending the comment period to March 30. I remain concerned, however, that the full and appropriate review of the DEIR may have been curtailed and may still be curtailed, by a number of factors:

- The Notice of Availability identifies three public locations where hard copies of the DEIR may be viewed in addition to on-line viewing. However, for the latter part of that period public buildings were closed to the general public due to the COVID-19 pandemic. This made it difficult for those with slow or no wi-fi connections to review the documents. P69-2
- The current health crisis may have rendered it difficult for other responsible and affected agencies to respond.
- The DEIR purports to address adoption of a Specific Plan and Master Plan, but these documents were only made available on-line after the original March 23 comment deadline, and the project description glossed over important project information in those documents, as discussed below.

I am extremely concerned about public participation as project processing continues. As stated in Section 15002 (a) of the Guidelines for the Implementation of the California Environmental Quality Act (CEQA): P69-3

> The basic purposes of CEQA are to: (1) Inform governmental decision makers and the public about the potential, significant environmental effects of proposed activities…

The courts have repeatedly emphasized CEQA's function as a public disclosure and public participation process. As stated in Guidelines Section 15003

> …the courts of this state have declared the following policies to be implicit in CEQA:
>
> (a) The EIR requirement is the heart of CEQA. (County of Inyo v.Yorty, 32 Cal. App. 3d 795.)
> (b) The EIR serves not only to protect the environment but also to demonstrate to the public that it is being protected. (*County of Inyo v. Yorty*, 32 Cal. App. 3d 795.)
> (c) The EIR is to inform other governmental agencies and the public generally of the environmental impact of a proposed project. (No Oil, Inc. v. City of Los Angeles, 13 Cal. 3d 68.)
> (d) The EIR is to demonstrate to an apprehensive citizenry that the agency has, in fact, analyzed and considered the ecological implications of its action. (*People ex rel. Department of Public Works v. Bosio*, 47 Cal. App. 3d 495.) …

Per *County of Amador v. El Dorado County Water Agency* 1999 (76 Cal. App. 4th 931)

> "The EIR...is a document of accountability...The EIR process protects not only the environment but also informed self-government." Thus, the CEQA process is, above all, a public participation process.

P69-3 cont'd

Costa Mesa City Hall is closed to the public due to COVID-19. The Costa Mesa City Council Chambers are also closed to the general public, with all public hearings now being held telephonically. While members of the public may submit comments on agenda items in advance or via e-mail during the meeting, a somewhat unwieldy procedure, members of the public have no opportunity to comment in person or to call in comments. All communication by the public must be in writing, either hard copy or electronic.

Often a member of the public has comments which are triggered by a staff presentation or by the comments of the previous speaker. Thus, the comment could not have been submitted in advance. Historically, problems have arisen with comments submitted electronically to the City of Costa Mesa ending up in a city spam folder. Further, members of the public have complained that comments have been limited to a given number of characters or bites.

The One Metro West project must be subject to a public hearing with full participation by members of the public, excluding no one, not even the electronically challenged among us. The magnitude of this project is too significant to do otherwise.

<u>Uses of the EIR</u>

Costa Mesa is the lead agency for the project. As stated in Section 3.5 of the DEIR (p. 3-27)

> This Draft EIR is a project-level EIR that examines the environmental impacts of the proposed project. This Draft EIR also addresses various actions by the City and others to adopt and implement the proposed project. It is the intent of this Draft EIR to evaluate the environmental impacts of the proposed project, thereby enabling the City, responsible

P69-4

agencies, and interested parties to make informed decisions with respect to the requested entitlements.

As listed in Section 3.5, implementation of the proposed project would entail the following discretionary approvals from the City:

- General Plan Amendment
- Zone Change
- Specific Plan
- Master Plan
- Development Agreement
- Tentative Tract Map
- Tree Removal Permit
- Public Art Plan

Thus, if the EIR is to fulfill its stated purpose per Section 3.5, it must provide decision makers and the public generally with complete, accurate, and adequate information as the scope and nature of the proposed project and anticipated environmental impacts associated with implementation of the project.

Approvals needed from other agencies as part of the project include: P69-4 cont'd

- California Public Utilities Commission - General Order 131D and Section 851 (Transfer or Encumbrance of Utility Property) approval
- Orange County Flood Control District (OCFCD) - Encroachment Permit within OCFCD right-of-way
- Santa Ana Regional Water Quality Control Board - National Pollution Discharge Elimination System (NPDES) Permit
- Orange County Sanitation District – Approval of proposed sewer improvements
- Orange County Airport Land Use Commission - John Wayne Airport Environs Land Use Plan Consistency Determination
- City of Fountain Valley - Implementation of recommended Mitigation Measure T-2 regarding traffic improvements

The EIR is intended to provide environmental information to the above responsible agencies, trustee agencies, and other public agencies which may be required to grant approvals and permits. It must thus offer sufficient information about the proposed project and potential impacts for those agencies to fully evaluate aspects of the project for which they are responsible agencies.

Adequate review of project impacts is hampered by a number of factors. These include an incomplete project description and failure to provide analyses necessary to a full assessment of project impacts consistent with the Costa Mesa General Plan and maintenance of a quality environment for the residents of Costa Mesa.

Inadequate Project Description

The DEIR includes only the vaguest description of the proposed development, no parking plan, no floor plans, few elevations and no project elevation from the most sensitive nearby land use, i.e. the residential area to the south, no tract map, no public art plan, and minimal information regarding the proposed specific plan and other aspects of project approvals.

The project description provides the basis for all analyses contained within the EIR. It is the very foundation of the document and, thus, of the public's and decision-maker's review and subsequent decisions. A vague or incomplete project description will render all further analyses and determinations ineffectual. As stated in *McQueen v. Board of Directors of the Mid-Peninsula Regional Open Space District* (202 Cal.App.3d 1136, 1143; 249 Cal.Rptr. 439), "An accurate project description is necessary for an intelligent evaluation of potential environmental effects of a proposed activity".

In setting aside the approval of an EIR by the City of Los Angeles for water development facilities in Inyo County, the court stated: "An accurate, stable and finite project description is the is the Sine qua non of an information and legally sufficient EIR" (*County of Inyo v. City of Los Angeles* (71 Cal.App.3d 193) [139 Cal.Rptr. 401]). A complete and accurate project description is the most basic and important factor in preparing a lawful EIR. P69-5

It is critical that the project description be as clear and complete as possible so that the issuing agency and other responsible agencies may make informed decisions regarding a proposed project. In fact, the project description contained in the DEIR for the One Metro West project is so wanting as to render meaningless numerous analyses, such as they are, within the document. Deficiencies are so severe they can only be remedied by preparation and circulation of a new DEIR which fully and accurately defines the proposed project and provides analyses based thereon.

Important aspects of the proposed project could only be found in other documents only recently made available on-line. Decision makers and the public generally should not be required to ferret out information flipping back and forth amongst various documents. Decision makers and the public generally should not be required to obtain other documents for such basic issues as what the proposed project might look like from nearby residences.

While some information regarding the proposed project is included in the DEIR, it is incomplete, vague and inconsistent. These flaws must be remedied and provided in a recirculated Draft Environmental Impact Report.

Specific Plan

The DEIR provides little information regarding the Specific Plan and some of what is provided is not consistent with the draft Specific Plan posted on-line. The Specific Plan must be included as an appendix to a recirculated DEIR. P69-6

The DEIR indicates that residential structures will be a maximum 98 feet in height (p. 3-11). By contrast the Specific Plan (pp. 2-14, 3-6; Table 2-5) indicates that maximum height for residential structures would be 103 feet, with a maximum deviation of an additional 5 %, for a height just over 108 feet. Architectural projections would be permitted up to 113 feet per Page 2-14 of the Specific Plan, though Page 4-19 indicates that architectural projections would not count toward building height. Though the Master Plan does show the structures at 98 feet, as stated in the DEIR, changes in height could be approved at a staff level without a public hearing (SCA AE-2, p. 5.1-8). Thus, the project description in the EIR as well as analyses of shade and shadow and other aesthetic factors must be revised to reflect the maximum allowable height under the zoning/Specific Plan.. P69-6 cont'd

The DEIR indicates that parking would be provided at a ratio of 1.3 parking spaces per residential unit. The Specific Plan (p. 3-11; ex. 3-1) indicates that 1.75 spaces would be required for each dwelling unit. P69-7

The DEIR includes a list of permitted uses and conditionally permitted uses (Table 3-3) which while fairly broad has some limitations and is not open ended. The Specific Plan (p. 3-2) states the following:

> Any use not specifically permitted, or permitted with a Minor Conditional Use Permit per Table 3-1, or prohibited per the list of prohibited uses for the base zoning district (in this case, PDR-HD, Planned Development Residential – High Density) contained in Table 13-30 of the Costa Mesa Municipal Code, shall be reviewed by the Development Services Director to determine its similarity to another listed use. If no substantial similarity exists, the unlisted use shall require approval of a Conditional Use Permit prior to establishment of the use. P69-8

Thus, uses other than those listed in the DEIR could potentially be approved pursuant to approval of a use permit.

One of the ostensible purposes of the Specific Plan is " to encourage adaptive reuse of existing industrial structures" (p. 1-8). However, as described in the DEIR, all existing structures will be removed form the subject property. These apparent conflicts must all be resolved. P69-9

Master Plan

The One Metro West Master Plan includes important information and graphics showing building design, lighting, parking, site elevations and architectural renderings. These graphics are essential to a full understanding of the proposed project and must be included in a recirculated DEIR, preferably in the main body of the DEIR but at a minimum in an appendix. P69-10

Public Art Plan

Project approvals include a public art plan, but options for the plan are described in only the vaguest terms. It is not clear if a mural is proposed for the south side of the building or if decorative treatments such as a weave or fin system will be employed. Is any other art proposed? The public art plan must be included as an appendix to a recirculated DEIR. P69-11

General Plan Amendment

In March 2019, when the Costa Mesa City Council voted to accept the proposed general plan amendment for processing, it was proposed the site be designated Urban Center Commercial. At P69-12 what point was the proposal changed to High Density Residential and why? Is there a public record of a formal decision?

The Urban Center Commercial designation permits residential development at up to eighty dwelling units per acre. However, it does not apply density limits for each use to the entire site, but prorates allowable density based on the site area used as follows (General Plan Land Use Element p. LU-41):

> For mixed-use projects that include separate or distinct components, the nonresidential FAR standard and the residential density standard shall apply to each of the respective components, not the entire project site.

P69-12 cont'd

If that approach were applied, how many residential units per acre are proposed just for the residential portion of the site? How does this density compare to residential development elsewhere in Costa Mesa? What would be the floor area ratio for the office portion of the site? How does this development intensity compare to development intensity elsewhere in Costa Mesa?

Bike Trail

The proposed project is stated to include a bike trail connection to the Santa Ana River Trail, but such a connection between the river trail and Sunflower Avenue already exists. The approximately eight foot wide cement trail is nicely landscaped and in good condition, though somewhat messy right now due to Caltrans freeway construction. Why would replacement be necessary? Does the applicant proposed to remove and replace the existing trail? Why?

The existing trail connects onto a public street, whereas it appears that the trail proposed by the applicant would connect only onto private property on the project site and traverse the open space area. Is this intended to supplement the existing trail along the westerly edge of the project site or replace it? What is the reason? Would public access to the trail be maintained at all times? Even when the open space area is closed to the public? Will access be impeded during trail reconstruction?

P69-13

The existing bike trail is marked for public use and there is no "permission to pass" sign. Apparently, as stated in the Specific Plan (p.5-1) the City of Costa Mesa holds an easement for the trail. How was the easement acquired? What conditions attach to continued possession of the easement? If the trail no longer followed the easement would the easement be considered abandoned? In favor of whom would the easement be abandoned? Does the applicant intend to provide an irrevocable easement to the City for public use of the trail on the project site at all times without limitation?

Some of the graphics in the Master Plan appear to indicate that project open space would extend up to the parking spaces on the adjacent property and onto where the trail currently exists. Was that area included in the stated site area of 15.23 acres? Was any other portion of the bike trail included in calculation of site acreage and thus of site density?

P69-14

Tract Map
While approval of a tentative tract map is listed among project approvals for which the DEIR will be utilized, the DEIR provides no tract map. Would the office building be on a separate lot? Would the open space area be on a separate lot? Could these be sold off separately from the residential portion of the project? Will any portion of the existing bicycle trail be included in the tract map? Will all city easements be preserved? Does the tract map include a bike trail easement in favor of the City? If the DEIR is indeed intended to address approval of a tentative tract map per DEIR Page 3-27, then the tract map must be shown in a recirculated DEIR. P69-15

Transfer/Encumbrance of Utility Property
What utility property will be transferred or encumbered? P69-16

Staging/Phasing
Where will storage of construction materials and construction staging take place? The open space area could not be used after Phase 1, as that is stated to be included in the first phase of development (p. 3-26). Would an off-site area be utilized? Where? What access routes would be utilized to and from the staging area? The EIR must address impacts on the staging area and access routes between the staging area on the project site, including but not limited to energy, air quality and traffic impacts. P69-17

<u>Inconsistencies</u>

Numerous inconsistencies between the on-line Specific Plan and the project as described in the DEIR have been noted above. The project description in the DEIR is also internally inconsistent. For example, the DEIR (p. 3-9) indicates that solar panels will be installed in all south facing roofs. However, site elevations (Fig. 3-11a,b,c) do not show any south facing roofs. The discussion of energy use indicates only that installation of solar ready rooftops, though not solar itself, would be encouraged (p. 5-4-9). P69-18

All inconsistencies must be resolved.

<u>Defining Impacts Out of Existence</u>

It is not clear how thresholds of significance were selected. In some cases they follow widely accepted thresholds adopted by regional authorities or regulatory standards adopted by various levels of government. In other cases it is a mystery.

In any case the DEIR's benchmarks for significance appear to be boilerplate and insufficient to the task of reviewing a complex, multi-part development on a unique site adjacent to a freeway but also in close proximity to low density, single family homes. P69-19

The criteria in many cases such as noise and energy use, simply defer to state or city codes. If compliance with the barest legal requirements were the only requirement for a finding of no significance, there would be no point to even preparing an EIR. It would simply be a matter of compliance with other regulations. No violation would equal no impact.

The significance threshold for vibration seems to be level at which damage occurs on engineered masonry structures, not the level affecting human beings. That is clearly not consistent with the intent of the California Legislature in adopting the California Environmental Quality Act. As stated in Public Resources Code Section 21000:

> The Legislature finds and declares as follows:
> (a) The maintenance of a quality environment for the people of this state now and in the future is a matter of statewide concern.
> (b) It is necessary to provide a high-quality environment that at all times is healthful and pleasing to the senses and intellect of man….

P69-19 cont'd

It is clear the well-being of the people of the State of California was of paramount importance to the Legislature in adopting CEQA .

One of the purposes of CEQA is to "enable the public to determine the environmental and economic values of their elected and appointed officials" (Guidelines 15003(e)). One would hope that decision makers for this project share the Legislature's desire for a quality environment and desire to take action to protect **people**, not just buildings, from unnecessary noise and vibration.

Use of Standard Conditions

The DEIR identifies many Standard Conditions of Approval which would mitigate potential impacts. These standard conditions of approval as well as all other conditions msut be included in the mitigation monitoring program for any approved project.

P69-20

In addition to severe concerns about the systemic flaws which permeate the DEIR as a whole, I also have the following additional concerns:

Aesthetics

It is dismaying that the DEIR provides so little in the way of graphic illustration of the proposed project. Instead, one is referred to the graphics in the Master Plan (DEIR p. 5.1-16).

The proposed structures will be several orders of magnitude taller than any other structures in the surrounding area. It will potentially result in abrupt changes in scale and extreme visual intrusion into the skyline. This issue must be addressed in a recirculated DEIR.

A few photos of the existing site are provided, but it is astonishing that no renderings are provided for a project of this magnitude. Very small scale site elevations are provided in Section 3, but only views of the north and west, and neither the east and nor the south.

P69-21

It is distressing that the DEIR provides no analysis of the proposed project as seen from the residences to the south. The existing building at 1683 Sunflower is already visible from many locations in the state streets south of the freeway. The digital signs at SOCO are visible from many homes south of the freeway as far south as Gisler Avenue. At several times larger than the existing structure or the digital signs, the proposed development will loom over the homes south of the freeway. It boggles the mind that no one thought to address this in the DEIR. Even more mind boggling, apparently someone thought it might be a fun idea to add colored lights which change according to a computer program--just in case the unadorned structure was not visually intrusive enough for the residents (p. 5.1-11). This must be addressed in a recirculated DEIR.

Rendered photos of the project as seen from the Santa River levee/bicycle trail and from homes south of the 405 must be provided in a recirculated DEIR. Daytime and fully illuminated night time photo renderings are essential. Suggested locations include the public street/sidewalk at on the south side, views toward the site from the front of homes on north/south oriented streets in the area between Dakota and Minnesota, views from California at Minnesota or Dakota and views from Gisler.

P69-21 cont'd

The proposed mitigation measure and standard conditions do little to mitigate the likely impacts. The requirement that any changes to lighting plans, building height or other visual aspects of the project be approved by various city bodies provides no assurance that impacts will be eliminated or even reduced to the extent feasible. There is no reason for confidence or comfort in light of the visual insult inflicted on homes in the state streets by the digital signs at SOCO which were presumably approved by some city official or body of officials.

Rather than dimming the lights at 10 pm, they must be on dim all evening and turned off completely at 10 pm. Changing lights must not be permitted. The prohibition on signage above the first floor must be applied on the south side of the structure, not just the other facades as currently proposed (Specific Plan p. 4-15). P69-22

Photovoltaics proposed for the southerly building façade could result in reflected glare both onto the freeway and into the residential area. This must be fully mitigated. P69-23

The analysis of shade and shadow must be revised to reflect the maximum building height permitted under the Specific Plan. As noted above, building height could easily be modified at the staff level in the future. P69-24

Absent the information requested above, it cannot be stated unequivocally that the proposed project will not result in adverse impacts to aesthetic factors. The information must be fully compiled and provided in a recirculated EIR in order that the public and decision makers may be fully informed as to all characteristics, impacts, and degree of mitigation of all impacts of the proposed project. P69-25

Air Quality

The Costa Mesa General Plan Conservation Element includes the following:

> Policy CON-4.A.3: Require that sensitive uses such as schools, childcare centers, parks and playgrounds, housing, and community gathering places are protected from adverse impacts of emissions.

P69-26

The DEIR also indicates that a significant impact would occur if sensitive receptors were exposed to substantial pollutant concentrations (p. 5.2-15). Sensitive receptors are normally considered to include residences and parks. This must be addressed in light of air emissions associated with the adjacent 405 Freeway. P69-26 cont'd

It is disappointing that the EIR does not include the health risk assessment specifically requested by the South Coast Air Quality Management District in their June 11, 2019 letter submitted in response to the Notice of Preparation for this EIR. This is contrary to the Legislature's statement that it is the policy of the state to take all action necessary to provide the people of this state with clean air (PRC 20001 (b)) and that it is necessary to provide an environment that is at all times healthful (PRC 20000(b)).

The California Air Resources Board has cautioned against siting housing within 500 feet of a freeway, noting adverse health effects on sensitive land uses in their 2005 Air Quality and Land Use Handbook. CARB has since released a technical advisory (California Environmental Protection Agency. California Air Resources Board. Technical Advisory: Strategies to Reduce Air Pollution Exposure near High-Volume Roadways. April 2017) which includes strategies for reducing these adverse health effects on residents including measure to increase air flow and use of high efficiency air filters. The EIR must identify which measures in the technical advisory which will be incorporated onto the project. P69-27

The DEIR does not address ventilation of the parking structures. What measures will be taken to ensure against propagation of car exhaust into the residential structures? P69-28

The California Air Resources Board estimates that ride hailing services generate fifty percent more air emissions per passenger mile than traditional vehicles (California Air Resources Board, SB 1014 Clean Miles Standard 2018 Base-year Emissions Inventory Report, December 2019). What assumptions were made regarding use of ride hailing services by future project residents in calculation of mobile air emissions? P69-29

Energy

It is not clear what assumptions were made in calculating energy use. What was assumed regarding gas and electricity consumption per dwelling unit? Per square foot of commercial? Were assumed consumption rates typical for all similar uses, regardless of locations or did consumption rates take into consideration additional energy needed for air filtration due to the project's proximity to the freeway? P69-30

Geology and Soils

How many cubic yards of artificial fill will be removed and re-engineered? Will any soil be removed from the site? How much? Was this degree of grading included in calculation of construction emissions and energy consumption? P69-31

Greenhouse Gases

What steps, other than compliance with state and local codes, is the applicant taking to provide a sustainable development? Will the project meet standards for LEED certification? At what level? P69-32

<u>Hydrology</u>

It appears likely that groundwater will be encountered during site excavation. Has the water quality been tested? Is it known to contain any pollutants? What will be done to dispose of any groundwater pumped during construction of the project?

The DEIR indicates that 19 modular wetlands systems will be used to remove sediments and other pollutants (p. 5.8-18) and refers the reviewer to Exhibit 3-9 in the DEIR. However, Exhibit 3-9 shows only one "infiltration system". Where will the modular wetlands systems be located? Will they occupy a significant portion of the open space area? This must be mapped. P69-33

Manmade wetlands and retention basins have proven to be breeding areas for mosquitoes on in many instances. What will be done to control mosquitoes in the modular wetlands systems, infiltration systems, or retention basins?

<u>Land Use</u>

The proposed project represents a substantial departure from the type of development currently existing in the area. The EIR must address potential conflicts with the industrial park uses currently existing in the area, including marijuana related businesses approved pursuant to Measure X. P69-34

The EIR must address project open space, setbacks and overall development intensity as compared to other development in the Harbor Gateway area. The EIR must address the potential precedent setting nature of the proposed project should it be approved. P69-35

<u>Noise</u>

Incompatible Noise Environment

The DEIR recognizes the high noise levels generated along the freeway (p. 5.10-8) and presents the land use compatibility standards included in the Noise Element of the Costa Mesa General Plan (DEIR p. 5.10-6). The DEIR even lists policies in the Noise Element designed to protect sensitive uses from noise and to require noise reduction measures in residential and other noise sensitive uses near freeways. The DEIR discusses the psychological and physiological effects of noise.

Yet the DEIR utterly fails to address the potential impact of noise on the proposed residences and park area or identify the mitigation measures needed to achieve a noise environment consistent with general plan standards for the various uses, or even acknowledge a potential conflict with adopted general plan policy—or effects on human health. Part of the California Legislature's stated intent in adopting CEQA was to " Take all action necessary to provide the people of this state with … freedom from excessive noise" (PRC 21001 (b)). Examination of the noise environment and its effects on people is at the core of the California Environmental Quality Act. P69-36

As stated in the proposed Specific Plan (p. 3-17-18):

> The noise standards outlined in Chapter 13 (Noise Control) of Title 13 (Planning, Zoning

> and Development) shall apply with the following exceptions. The exterior noise standards shown in Section 13-280 subsection (a) shall only apply to the common outdoor recreational amenity areas located on the ground level. Recreational amenity areas located above the ground level are also exempt… ***These standards do not apply to the non-residential components of the Specific Plan including the publicly-accessible open space area.*** [Emphasis added]

P69-36 cont'd

The DEIR must address the apparent conflict between this section of the proposed Specific Plan and the City's Noise Element. The preparers are reminded that a specific plan is intended to implement a general plan (Government Code Section 65450) not replace it, and that a specific plan must be consistent with a general plan (GC 65454).

Construction Noise

The discussion of noise identifies the exemption from noise limits applied to construction activities during certain hours and then blissfully concludes that the noise is then, somehow not annoying, no matter how loud. The DEIR's only concern is adherence to a legislative construct, not annoyance to those in the surrounding area nor even threats to human health or hearing loss.

Under this reasoning, patrons of food purveyors at SOCO will be happy to enjoy a snack at an outdoor bench while the jackhammers pound away. Standing next to a compressor or generator running at 80 dB would be perfectly comfortable whereas a drum generating noise at 80 dB would be unbearably annoying. And magically, you could stand next to an impact pile driver operating at over 100 dB all day long without any hearing loss because it's just construction equipment! This clearly makes no sense, though it does, of course, exempt the project developers from taking any responsibility to reduce construction noise for the sake of commercial neighbors.

P69-37

Communities have noise ordinances because excessive noise is annoying and can even have impacts on human health. It's ***significant***. Communities also typically exempt construction noise because it would be impossible to build anything without making noise. It's ***unavoidable***. At the same time, recognizing how unpleasant, how ***significantly*** unpleasant, construction noise can be, construction is limited to certain times and days. It's the very definition of significant and unavoidable.

The EIR must identify areas that will be exposed to significant unavoidable noise levels from any source associated with implementation of the proposed project and identify any potential measures that might reduce the noise impact. At a minimum construction equipment must be outfitted with mufflers to the extent feasible and the site must be posted with a 24-hour-a-day contact for noise complaints, especially so that noise outside normally approved hours can be controlled.

Vibration

The discussion of vibration also takes a strange turn. The DEIR recognizes that vibration at .10in/sec begins to annoy people (p. 5.10-4), and that at .20in/sec it is even annoying to people in buildings. According to the DEIR damage to non-engineered timber and masonry buildings would begin to occur at 0.2 in/sec with some susceptible buildings sustaining damage at 0.12in/sec (p. 5.10-12). However, annoying or damaging as it may be, vibration is not defined

P69-38

in the EIR as exceeding an acceptable threshold until reaching .30in/sec.

What is the basis for the chosen threshold? Are structures deemed to be more important than people? Even so, the potential for structural damage appears to exist. Who will be responsible for any damage to off-site structures? The EIR must map the area which will be subject to vibration at levels acknowledged by the EIR to be annoying, i.e., 0.1in/sec and levels at which off-site structures could begin to sustain damage. Mitigation measures must be identified and implemented to the extent feasible. Repair of all off-site damage must be the responsibility of the applicant. P69-38 cont'd

All of this must be addressed in a recirculated DEIR in order that the public and decision makers may be fully informed as to the full extent of noise and vibration impacts and degree of to which impacts can be mitigated.

Population and Housing

What portion of the housing will be affordable to low and very low income households? Conditions of approval must specify ongoing affordability and full integration of affordable units into the project. P69-39

The Specific Plan (p.4-18) states that the project would "Provide amenities as part of each residential building that are appropriate to the different age groups of residents". Do the applicants propose to segregate residents by age? Is this legal? P69-40

Public Services/Recreation

The City of Costa Mesa General Plan specifies a park standard of 4.24 acres of parkland per one thousand people. At that rate, the 1.5 acres of semi-public open space is far from adequate to meet the city standard.

In 2015, the City of Costa Mesa adopted a park impact fee for multi-family development. The City adopted a fee of about half that which could have been justified by a study prepared by David Taussig & Associates, recognizing the burden a higher fee would place on home builders. Thus, even when adopted, the park fee was not expected to fully pay the cost of new recreation facilities needed by new residents. Since that time, costs for both land and improvements have increased, so the fee offsets a smaller portion that justified costs. P69-41

In order for a fee to fully mitigate and impact, the fee must result in full cost recovery. The Costa Mesa fee doesn't. The DEIR must identify the extent to which impacts on park facilities, including degradation of the ratio of parkland to population, are not mitigated.

Will access to the existing bicycle trail connection from Sunflower to the Santa Ana River Trail be impeded during project construction? Will bike trail access from Sunflower to the river trail be available at all times upon completion of the project? P69-42

Will visitors to the on-site quasi-public open space be permitted to park on-site? If not what impacts will be sustained south of the freeway, a short walk or bike ride through the tunnel under the 405? Will visitors to commercial, residential, and open space uses within the project be induced to park south of the 405 thereby impeding public access to Moon Park and the bicycle staging area provided by the park? P69-42 cont'd

Transportation

Existing Conditions

The existing level of service data provided in the DEIR (p. 5.13-15) do not seem to comport with reality. In the afternoon to early evening, sometimes starting as early as 3 pm and extending as late as 7 pm, it is not unusual to have to sit through two or more light cycles at the 405 and Harbor, South Coast/Harbor and Sunflower/Harbor. Southbound on Harbor on a weekday afternoon around 5pm or 6 pm, I have many times been unable to move into intersections on the green light because traffic has not cleared from the next light south; This has commonly started as far north as Segerstrom in Santa Ana with the backups not clearing until the 405 or Gisler. P69-43 Once it was backed up all the way to Warner. There was no sign of an accident when the traffic finally cleared at Gisler.

There is either a problem with the trip counts or with our signal timing, but it is normal to sit through more than one cycle of the lights in the Gisler to Sunflower portion of Harbor in the afternoon in both directions due to failure of the preceding traffic to clear the intersection ahead.

Construction Traffic

What are the anticipated haul routes for construction traffic? To the extent feasible haul trips must occur outside peak traffic hours.

P69-44

How long will any "temporary" lane closures last? If more than just a few minutes on an occasional basis, what will be done to reduce the need for lane closures?

Operational Traffic

The DEIR must address how narrowing Sunflower in the project vicinity will affect traffic flow, both now and in the future. P69-45

Does trip generation for the proposed project include double trip ends in the immediate vicinity due to use of ride hailing services? This must be addressed. P69-46

Utilities

The water supply assessment included in Appendix N (p.42) concludes as follows:

> The information included in this Water Supply Assessment identifies programs and activities that collectively represent reasonable opportunities to ensure an adequate supply of water for Mesa Water®, inclusive of the subject Project, now and into the future. P69-47
>
> Mesa Water® can provide an adequate supply of water and has opportunities to increase water resources by the following methods. First, Mesa Water® has the capability of utilizing additional groundwater capacity from the existing wells. Second, **water**

conservation efforts and regulations can provide additional water resources. [emphasis added]

Does the above passage mean that existing water users will be expected to make do with less to accommodate new development? P69-47 cont'd

Growth Inducing Impact

The project clearly has the potential to create a precedent-setting action. It is the first high density residential project is that section of Costa Mesa. If it is successful, it will not be the last. While the project has the potential to lower property values south of the freeway due to significant visual intrusion, it is likely that the project would create upward pressure on land prices (as the economy stabilizes after the current pandemic) , as happened in the southwesterly portion of the city after residential development took hold in traditional industrial areas. This would increase market pressure to replace existing lower intensity uses with high intensity housing or commercial uses.

P69-48

The proposed project provides a lower proportion of open space and smaller setbacks than nearly anywhere else in Costa Mesa. This has the potential to set a huge precedent for higher intensity development city wide.

Unfortunately, while the City has a well thought out Specific Plan for the entire area north of the freeway and points east of Harbor, there is no such plan for the area west of Harbor. Absent such a cohesive plan, it is likely that the area west of Harbor will redevelop with a hodge podge of uses which will strain infrastructure and ultimately lead to a reduction in quality creative office and research businesses offering good jobs in the city.

Conclusion

In accordance with Section 15088.5(a) of the CEQA Guidelines, a lead agency must recirculate a Draft EIR:

> when significant new information is added to the EIR after public notice is given of the availability of the draft EIR for public review under Section 15087 but before certification. As used in this section, the term “information” can include changes in the project or environmental setting as well as additional data or other information. New information added to an EIR is not “significant” unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project’s proponents have declined to implement. “Significant new information” requiring recirculation include, for example, a disclosure showing that: P69-49
>
> > (1) A new significant environmental impact would result from the project or from a new mitigation measure proposed to be implemented.

(2) A substantial increase in the severity of an environmental impact would result unless mitigation measures are adopted that reduce the impact to a level of insignificance.
(3) A feasible project alternative or mitigation measure considerably different from others previously analyzed would clearly lessen the environmental impacts of the project, but the project's proponents decline to adopt it.
(4) The draft EIR was so fundamentally and basically inadequate and conclusory in nature that meaningful public review and comment were precluded. (Mountain Lion Coalition v. Fish and Game Com. (1989) 214 Cal.App.3d 1043)

The information provided in the DEIR is not adequate for any reviewer, whether decision makers or the public generally, to determine whether all aspects of the proposed project have been fully evaluated and all impacts mitigated to the extent feasible. In fact, the information provided in the DEIR is not adequate for any reviewer to fully understand the nature of all components of the project. The EIR must be revised and recirculated to include details regarding the Specific Plan, which must also be included as an appendix to the recirculated EIR. Important analyses regarding air quality, visual impacts, and noise must be prepared and made available to the public. P69-49 cont'd

As currently presented, the DEIR fails utterly to fulfill the purposes of CEQA. The document must be revised and re-circulated in accordance with Guidelines Section 15088.5(a) (4) in order that the public and decision makers may be fully informed.

Thank you for the opportunity to comment. Please keep me informed as this project progresses.

Yours truly,

Sandra L. Genis

From: GENIS, SANDRA
Sent: Monday, March 30, 2020 4:13 PM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>
Subject: screen check numbers

I did not put this in my EIR letter, but technically the EIR is supposed to have the State Clearinghouse Number on the title page. per Guidelines SEction 15082 e. Within a small to moderately sized community it doesn't make much difference, but having the clearinghouse number on the title page is helpful to state and regional agencies that may be tracking numerous documents as responsible agencies. P69-50

The colored card stock dividers were really helpful in navigating the document.

P69. RESPONSES TO COMMENTS FROM SANDRA GENIS, MARCH 30, 2020.

P69-1 This introductory comment provides a brief summary of the proposed project. Responses to specific comments within the comment letter are provided below.

P69-2 The commenter is concerned that the full and appropriate review of the Draft EIR may have been compromised due to COVID-19. For example, City buildings were closed to the general public thereby making it difficult for people with slow or no internet connection to review the Draft EIR on-line and agencies may have been preoccupied with the current health crisis to respond in time.

The Draft EIR was made available for public review starting from February 7, 2020 through March 23, 2020, pursuant to CEQA Guidelines Section 15073 (a 45-day public review period). However, as a result of the COVID-19 pandemic, the City of Costa Mesa had to close public access to City Hall, and the City's libraries, starting March 16, 2020. Due to these closures, the City extended the public review period through March 30, 2020. An announcement of the seven day extension was posted on the City's website and comments were accepted through the end of the extended review period. For those with questions, the City's Development Services Department remained accessible via phone at (714) 754-5245, and Minoo Ashabi, the primary project contact at the City remained available, including to make arrangements to view the documents in person if necessary.

The commenter also indicates that the Specific Plan and Master Plan were only made available to the public after March 23, 2020. However, the Specific Plan and Master Plan have been available to the public at the City of Costa Mesa Development Services Department, 77 Fair Drive, Costa Mesa, California 92626 from February 7, 2020 through March 16, 2020 and then posted to the City's website on March 23, 2020.

P69-3 Refer to response to comment P52-3 pertaining to public hearings during the COVID-19 pandemic.

P69-4 This comment summarizes the project's required discretionary approvals from the City and other responsible agencies as detailed in Chapter 3, *Project Description*, of the Draft EIR. The commenter indicates that the EIR is lacking in a complete project description and full assessment of the project's impacts to provide sufficient information for the Lead Agency and responsible agencies to utilize when determining whether to approve the discretionary actions. Responses to specific comments regarding these comments are provided below.

P69-5 The commenter states the project description provided in the Draft EIR is lacking in full descriptions of the Specific Plan, Tract Map, Public Art Plan, and other project approvals, and is not adequate to properly analyze the project's environmental impacts. As detailed in CEQA Guidelines Section 15124, the description of the project is required to contain the following information: the precise location and boundaries of the proposed project on a map; a statement of project objectives; general description of the project's technical, economic, and environmental characteristics; and a statement briefly describing the intended uses of the EIR. Additionally, Section 15124 states that the project description should not supply extensive detail beyond that needed for evaluation and review of the environmental impact. Thus, it is not required for the project description to include all project details requested by the commenter, including a parking plan, floor plans, and project elevations from nearby residential areas, among others. Chapter 3, *Project Description*, of the Draft EIR summarizes the proposed development and various discretionary approvals, including the General Plan Amendment (Draft EIR page 3-7), Zone Change (Draft EIR page 3-7), Specific Plan (Draft EIR pages 3-7 through 3-21), Master Plan (Draft EIR pages 3-22 through 3-26), Development Agreement (Draft EIR page 3-26), Tentative Tract Map (Draft EIR page 3-26), Tree Removal Permit (Draft EIR page 3-26), and Public Art Plan (Draft EIR page 3-13). The information contained in Chapter 3, *Project Description*, and referenced within are utilized to fully evaluate the project's environmental impacts.

P69-6 The commenter states that the Draft EIR provides little information regarding the Specific Plan and requests the Specific Plan be included as an appendix to a recirculated Draft EIR. Refer to response to comment P69-5. The intent and framework of the proposed Specific Plan are detailed in the Draft EIR pages 3-7 through 3-21. Further, where applicable regulations from the Specific Plan would apply to various environmental topic areas, those proposed regulations are specifically discussed throughout Draft EIR Chapter 5.0, *Environmental Analysis*, as appropriate.

The commenter also identifies an inconsistency between the maximum allowed building height for the residential buildings between the Specific Plan (103 feet) and Draft EIR (98 feet). The maximum building height allowed per the Specific Plan is 98 feet. Therefore, no changes to the Draft EIR is required. The Specific Plan has been modified accordingly to ensure consistency.

Further, the commenter states that the shade and shadow analysis in Section 5.1, *Aesthetics*, of the Draft EIR needs to be revised to reflect the maximum allowable height of the proposed buildings, including the allowed five percent maximum deviation and any architectural projections (up to 108 feet in height). Based on the shade/shadow analysis, the only areas that would be substantially shaded are along the Sunflower Avenue right-of-way in the fall, winter, and spring months. However, this area is not shadow sensitive. Due to the orientation from the project site, no shading would result on the Mesa Verde residential community. Thus, additional height of the proposed project would not result in any significant shading of residential uses nor any other shadow-sensitive uses (uses where sunlight is important for function). Additional building height would not result in a new significant impact in this regard. Nonetheless, as stated above and as analyzed the Draft EIR, 98 feet is the maximum height permitted under the Specific Plan.

P69-7 The commenter identifies an inconsistency between the residential parking requirements in the Specific Plan (1.75 spaces per unit) and the Draft EIR (1.3 parking spaces per unit). This inconsistency is also found within the Specific Plan itself (Draft No. 6, dated March 2020). The correct residential parking requirement is 1.3 parking spaces per unit as detailed in the Draft EIR. The Specific Plan has been revised to be consistent with the Draft EIR. The Master Plan shows that the project would provide 1.75 spaces per unit, which exceeds the requirement per the Specific Plan.

P69-8 The commenter is concerned that other uses not detailed in Draft EIR Table 3-3, *Permitted and Conditionally Permitted Uses*, could be approved by the City's Development Services Director as he/she sees fit. The table is not meant to be an exhaustive list of all uses that could potentially be proposed

2. Response to Comments

on-site. As stated in the Specific Plan and cited in the comment, the City's Development Services Director would review the proposed unlisted use to determine its similarity to another listed use. If no substantial similarity exists, consistent with the Zoning Code, the unlisted use shall require approval of a Conditional Use Permit prior to establishment of the use. A Conditional Use Permit is a discretionary application, would be required to undergo environmental review under CEQA, and approval would be at the discretion of the Planning Commission, which would include opportunities for public participation at public hearing(s).

P69-9 The commenter correctly identifies a mistake in the Specific Plan stating that it would "encourage adaptive reuse of existing industrial structures." As the project would involve demolishing the existing industrial building on-site, no adaptive reuse of existing structures would occur. The Specific Plan has been revised to delete this statement.

P69-10 The commenter states that important information and graphics in the Master Plan should be included in the Draft EIR, at least as an appendix to a recirculated Draft EIR. Refer to response to comment P69-5. Additionally, including the Master Plan as an appendix would not change the analysis or conclusions in the Draft EIR. Applicable project detail from the Master Plan have been incorporated throughout Draft EIR Chapter 5.0, *Environmental Analysis*, as appropriate.

P69-11 The commenter states that the Public Art Plan should be included in the Draft EIR, at least as an appendix to a recirculated Draft EIR. Refer to response to comment P69-5. Additionally, including the Public Art Plan as an appendix would not change the analysis or conclusions in the Draft EIR.

To clarify, as stated in the Specific Plan, prior to submittals for building construction permits, the applicant will be required to submit a Public Art Plan for review and approval of the City's Cultural Arts Committee. The Public Art Plan will be required to include reference to long-term and short-term installations and address the following:

- Description of the artwork, including artist concept and drawings if available,
- Location of the artwork (long term and short term),
- Schedule for selection,
- Installation of the artwork(s),
- Plans for maintenance of the artwork(s),
- Security plan and replacement plans should any art be stolen or vandalized, and
- Public access to the artwork(s) during daylight hours.

The Public Art Plan would describe artwork proposed throughout the project site. Further as detailed in Draft EIR Section 5.1, *Aesthetics*, prior to issuance of the first building permit for the proposed project, the owner/developer would be required to submit a Design Plan for the Building A parking garage façade along the I-405 Freeway for review by the Planning Division and approval by the City's Cultural Arts Committee.

P69-12 The commenter states that as part of the General Plan Screening Application (in March 2019) the project proposed a General Plan Amendment to change the site to "Urban Center Commercial" rather than the current proposal for "High Density Residential" and questions why it was changed and how the project would be developed differently under the Urban Center Commercial designation.

City Council Policy 500-2 establishes a procedure for processing privately initiated General Plan Amendments. This procedure involves a City Council screening of these requests prior to their acceptance for formal processing. It is acknowledged that acceptance of the screening process does not constitute approval of the proposed project, including the proposed General Plan Amendment, but allows the applicant to receive feedback from the City Council to further develop the proposal and respond to City Council comments prior to submitting a formal application for a General Plan Amendment. As part of the research phase, the City of Costa Mesa Planning Division staff determined that based on past project approvals for high density projects in the City of Costa Mesa, and considering the proposed land uses at the site, the most appropriate course of action was to change the site's existing Industrial Park General Plan land use designation to High Density Residential with a site-specific base density of 80 dwelling units per acre and a site-specific maximum building height of seven stories. The Urban Center Commercial designation is intended for mixed use development; however, given that the project includes a substantial residential component, the High Density Residential land use designation (which is intended for residential development with complementary commercial uses per the General Plan Land Use Element) is a more compatible land use category and consistent with the proposed rezone to Planned Development Residential – High Density. Furthermore, the High Density Residential land use designation is consistent with previous approvals and entitlements for similar multi-family developments (e.g., Halcyon Apartments, Baker Block, and 580 Anton) in the City including those within the *North Costa Mesa Specific Plan*.

P69-13 The commenter requests clarifications regarding the improved bicycle trail connection from Sunflower Avenue to the Santa Ana River Trail. As shown on Draft EIR, Figure 3-5, *Conceptual Landscape Plan*, the proposed improvements at the western portion of the project site include an Open Space area. The western-most improvements include replacing the existing trail with a new trail alignment that would integrate the trail connection with the proposed Open Space area. Ingress/egress from Sunflower would be maintained. The project also proposes to improve the existing trail, west of the site (toward the Santa Ana River) to include treatments (including a possible entrance monument near the project site, possible resurfacing, and landscaping) to enhance the trail experience.

The proposed realignment of the trail along the western portion of the project site would occur within a trail easement that includes both the project site and the adjoining property to the west. During construction of the trail realignment, temporary closure of the trail would be required for approximately two to three months. Upon completion of the trail improvements, the public trail would be re-opened to the public. During construction activities the applicant would be required to provide

2. Response to Comments

detours through or around construction zones that are designed for safety and convenience, and with adequate signage for cyclists and pedestrians (PPP T-1).

Regarding the existing trail easement, the portion of the easement on the adjoining property would remain, the portion of the trail easement on the project site would be realigned consistent with the proposed Tentative Tract Map No. 19015 and continue to be publicly accessible. All existing public trail easement rights would be maintained through the proposed Tentative Tract Map No. 19015. Any portion of the realigned bicycle trail on private property would be required to dedicate a public access easement, as reflected on the project's Tentative Tract Map.

P69-14 For the purposes of the analysis presented in the Draft EIR, all on-site improvements were considered as part of the 15.23-acre project site[2]. In addition to the project site, off-site improvement areas were also considered, including off-site trail improvements and improvements along Sunflower Avenue. Per the City of Costa Mesa's Municipal Code, all residential density requirements are based on the acreage of the property being developed (15.23 acres) up to a maximum of 1,057 units as specified in the Specific Plan, Master Plan, and Development Agreement.

P69-15 Draft EIR Chapter 3, *Project Description*, page 3-26, details that the Tentative Tract Map is proposed to divide the site into five parcels and would include establishing the right to a future airspace subdivision for condominium purposes. The five parcels encompass the following:

- Lot 1 – Encompasses Building C;
- Lot 2 – Encompasses Building A;
- Lot 3 – Encompasses the Creative Office Building;
- Lot 4 – Encompasses the proposed Open Space area; and
- Lot 5 – Encompasses Building B.

Although the proposed Tentative Tract Map would establish the right to a future airspace subdivision for condominium purposes, the applicant intends for the product to be rental units and may choose not to exercise a condominium plan in the future. Per the proposed Tentative Tract Map No. 19015 (sheet 7 of 10), Proposed easement/dedication D is for public pedestrian sidewalk/access purposes to the City of Costa Mesa, and easement/dedication E is for public bike trail purposes to the City of Costa Mesa.

[2] It is acknowledged that the entire project site is 15.6 acres; however, approximately 0.37 acres along the southwest site boundary would be dedicated for the I-405 Freeway expansion. Therefore, the proposed development would occur on the remaining 15.23 acres.

2. Response to Comments

P69-16 The commenter questions what utility property would be transferred or encumbered as part of the project. No transfer or encumbrance of utility property would occur with the proposed utility improvements as all transmission lines would be converted from overhead to underground.

P69-17 The commenter questions where construction staging would occur and whether any off-site staging location would be utilized. Construction staging would occur on-site; no off-site staging areas or access routes between the staging area and project site are required or proposed.

P69-18 The commenter requests inconsistencies within the Specific Plan and Draft EIR be resolved. As detailed in response to comments P69-6 and P69-7, the Specific Plan will be updated to match the Draft EIR. More specifically, the commenter states that the Draft EIR indicates that solar panels would be installed on all south-facing roofs but the site elevation figures in the Draft EIR do not show any south-facing roofs. Draft EIR Figures 3-11a, *Building A Elevations*, through 3-11c, *Building C Elevations*, are elevation figures that illustrate cross-sections of each building; the figures are not meant to show detailed rooftop plans. The commenter also states that the energy analysis in the Draft EIR only indicates that installation of solar-ready rooftops, though not solar panels themselves, are encouraged. Installation of solar-ready rooftops are required under the 2019 CALGreen standards and thus, are analyzed throughout the Draft EIR as part of the project.

P69-19 The commenter requests clarifications as to how the CEQA thresholds of significance were selected to evaluate the project's environmental impacts. The thresholds of significance are based on Appendix G, *Environmental Checklist*, of the CEQA Guidelines, which have been adopted by the City of Costa Mesa and are utilized widely by various lead agencies. These thresholds are applicable to all projects under CEQA; individual projects do not have customized thresholds of significance based on any unique project characteristics.

Specifically, the commenter states that the noise and energy analyses defer to State or City codes. However, it is standard practice for the City of Costa Mesa to rely on the City's Municipal Code requirements to determine if a project is exceeding noise levels in the area. For example, one of the Appendix G thresholds of significance for noise is whether the project would "generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies." As such, the City's noise ordinance is utilized as the significance thresholds for construction and operational noise impacts. The project's construction and operational noise levels are compared to the City's thresholds to determine whether a potentially significant impact would occur. With regard to the energy analysis, one of the Appendix G thresholds of significance is whether the project would "result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation." Thus, the analysis quantifies the project's electricity and natural gas consumption and takes into consideration required compliance with existing energy conservation standards (e.g., 2019 California Building Energy and Efficiency [Title 24] Standards and 2019 CALGreen Standards) and proposed sustainable design features to determine whether a potentially significant impact would occur. There is no quantified threshold of significance for the "wasteful, inefficient, or unnecessary consumption of energy resources" given that all projects have varying degrees of energy consumption based on the nature of the project (e.g., a high-rise office building versus a ten-unit condominium development). As such, similar to other thresholds of significance in Appendix G of the CEQA Guidelines, the energy threshold of significance is subjective.

The commenter also questions why the significance threshold for vibration impacts is related to structural damage rather than adverse human effects. Refer to response to comment P69-38.

P69-20 The commenter requests that the Standard Conditions of Approval (SCAs) be included in the mitigation monitoring program for the proposed project. SCAs are imposed on a project-by-project basis and are a regulatory requirement of a development project. With these regulatory actions, many work toward reducing environmental impacts. As such, it is standard practice for the City of Costa Mesa to acknowledge SCAs in their environmental documents. The SCAs are included in the project's Development Agreement and enforced by the City's Development Services Department. Should potentially significant impacts remain after consideration of all regulatory requirements, additional mitigation measures are then imposed on the project, as reasonable and feasible.

P69-21 The commenter raises concerns regarding the proposed structures' potential changes in scale and intrusion into the skyline and requests daytime and nighttime photosimulations of the proposed development from the Santa Ana River Trail and "State streets" neighborhood sidewalks. As discussed in response to comment O2-2, CEQA Thresholds of Significance consider impacts to scenic views and, for urban environments, the potential to conflict with a regulation governing scenic quality. Private views from Mesa Verde residents are not scenic views. Further, as discussed in response to comment O2-2, implementation of the proposed project would not conflict with a regulation governing scenic quality. As such, additional details, such as photosimulations, would not change the findings or conclusions presented in the Draft EIR. Pertaining to nighttime lighting impacts, as discussed in response to comment P1-2, the Draft EIR Section 5.1, *Aesthetics*, considered proposed lighting impacts, including those to the Mesa Verde community to the south. The most visible source of lighting of the project site from the residences south of the I-405 Freeway would emanate from exterior lighting on Building A and interior parking structure lighting along the southern edge of the site. Refer to response to comment P1-2.

Regarding potential scenic views from the Santa Ana River Trail, as analyzed in Chapter 8, *Impacts Found Not to Be Significant*, the project would have no substantial adverse effect on a scenic vista. The City's physical setting allows for views of scenic resources including the Pacific Ocean, Santa Ana River, Upper Newport Bay, and Santa Ana Mountains. Views of these resources are afforded at specific public locations within the City that provide uninterrupted, large expanse views of undeveloped land and these resources. According to the General Plan EIR, such locations include Fairview Park, Talbert Regional Park and its adjacent wildlife refuge, and the golf courses, parks, and ballfields in the City. These specific locations are not located within views of the project site. The project site is located over 4.5 miles inland of the Pacific Ocean and over ten miles southwest of the Santa Ana Mountains. Views of the Pacific Ocean and Santa Ana Mountains are not afforded from the project site under existing conditions due to intervening topography, existing structures, and vegetation. Although the project site is located approximately 700 feet east of the Santa Ana River and a bicycle path extends from the project's western boundary to the Santa Ana River Trail, there are no visual resources (identified above) at this segment under existing conditions. Thus, photosimulations from the Santa Ana River Trail are not warranted. Similarly, existing skylines and views of the Santa Ana Mountains looking north from the Mesa Verde neighborhood are already partially obstructed under existing conditions due to intervening topography, existing structures, and vegetation. Thus, photosimulations of the proposed development from sidewalks within the "State streets" neighborhood are not warranted. As defined by the City's General Plan EIR, views from the "State streets" neighborhood are not scenic views.

Additionally, the commenter indicates that the proposed mitigation measures and SCAs related to aesthetics would do little to mitigate the likely impacts of the project. Based on the CEQA thresholds of significance, aesthetic impacts from the proposed project would be less than significant. Light and glare impacts were determined to be potentially significant, but with incorporation of recommended mitigation, would also be reduced to less than significant levels. It is acknowledged that the SCAs would be included in the Development Agreement and the mitigation measures are included in Chapter 4, *Mitigation Monitoring and Reporting Program*, of this Final EIR to ensure the City enforces such measures.

P69-22 The commenter states that the project's light fixtures should be dimmed all evening and completely turned off at 10:00 p.m., changing lights should be prohibited, and signage should not be allowed on the south side of the proposed buildings. The mitigation measures proposed as part of the Draft EIR are intended to ensure that the proposed lighting environment remain similar to those already experienced at the adjoining SOCO property. With incorporation of the proposed mitigation measures, the project would not result in new lighting levels that are substantially increased compared to the existing lighting levels for the area.

P69-23 The commenter states that photovoltaics proposed on southerly building façades could result in glare impacts on vehicles driving along the I-405 Freeway and in the residential area to the south. Photovoltaics is the direct conversion of light into electricity at the atomic level. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captured, an electric current results that can be used as electricity. The less reflective a photovoltaic panel is, the more absorption can occur. Thus, the intent of photovoltaic technology is to be as non-reflective as possible to achieve the highest level of light absorption. As such, photovoltaic panels typically are less reflective than other building materials and would not be a substantial source of new glare in the project area. Impacts in this regard would be less than significant.

P69-24 Refer to response to comment O2-2.

P69-25 Refer to responses to comments P69-21 through P69-24. Based on the responses, no significant new information was identified requiring recirculation of the Draft EIR.

2. Response to Comments

P69-26 The commenter requests that the Draft EIR analyze impacts of air quality emissions associated with vehicular traffic along the I-405 Freeway on the project's sensitive receptors (i.e., the proposed residences and open space area).

According to several court decisions, including *Baird v. County of Contra Costa* (1995) 31 Cal.App.4th 1265, *Ballona Wetlands Land Trust, et al. v. City of Los Angeles* (2011) 201 Cal.App.4th 455, and *California Building Industry Association v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369, CEQA analysis is not required to analyze impacts of the existing environment on a proposed project unless the project risks exacerbating existing environmental hazards. As detailed in Section 5.2, *Air Quality*, of the Draft EIR, project-level and cumulative operational air quality impacts associated with the project would be less than significant, and thus, would not exacerbate any existing environmental hazards, including the air quality impacts associated with vehicular traffic along the I-405 Freeway. In addition, even though the proposed project would generate additional trips on the I-405 Freeway, the number of additional trips is less than 0.5 percent of the existing and future traffic volumes on the I-405 Freeway and therefore is negligible and not significant. The potential health risk impacts from roadways are associated with diesel particulate matters from heavy diesel trucks, and because the project is a mixed-use development with residential units, retails, and offices, project-generated vehicle trips would be mostly passenger vehicles rather than heavy trucks. As such, analyzing the existing environment's air quality and health risk impacts on future residents of the project is not required under CEQA.

P69-27 The commenter is disappointed that the Draft EIR does not include a health risk assessment as requested by the South Coast Air Quality Management District. As requested by the South Coast Air Quality Management District (SCAQMD) in their June 11, 2019 letter submitted in response to the Notice of Preparation (NOP), a health risk assessment was conducted in addition to the air quality modeling. The findings from the health risk assessment are provided under Impact 5.2-1 (pages 5.2-22 and 5.2-23) and Impact 5.2-3 (page 5.2-25) in Section 5.2, *Air Quality*, of the Draft EIR. Refer to response to comment P69-26 pertaining to consideration of the environment on the project (such as consideration of the impacts of air quality emissions from the I-405 Freeway on future residents at the project site). Notwithstanding, it is acknowledged that a health risk assessment, dated August 2019, evaluating exposure of future residents near the I-405 Freeway was prepared for planning purposes at the request of the City and was provided to City decisionmakers for consideration. Based on this analysis and the thresholds of significance by the SCAQMD, future residents of the proposed project would not be exposed to any significant health risk level. Further, it is acknowledged that the project proposes to install two-inch Minimum Efficiency Reporting Value (MERV) 13 filters in all new multi-family residential buildings in accordance with CALGreen standards per the proposed Specific Plan.

P69-28 The commenter is concerned that car exhaust emissions generated in the proposed parking structures would propagate into the residential structures. Similar to other parking structures, the proposed parking structures would be open to the outdoors and exhaust emissions would disperse with time and distance. Exhaust emissions would not be able to concentrate within the parking structure and spread into individual residences. Additionally, window openings on the dwelling units in Building A are proposed to face away from the parking structure, which would also minimize cross ventilation.

P69-29 The commenter states that the California Air Resources Board estimates that ride sharing services generate fifty percent more air emissions per passenger mile than traditional vehicles and requests clarifications on the assumptions made in the Draft EIR regarding ride sharing services in the project's mobile air emissions. The trip generation estimates for the project were based on the application of industry recognized and standard trip rates for the various proposed land uses. The air quality emissions were calculated based on the project trip rates, trip lengths, and emission factors consistent with the latest California Air Resources Board and SCAQMD guidance for the preparation of air quality studies. Neither the Institute of Transportation Engineers nor SCAQMD provide recommendations or requirements for ridesharing assumptions in technical studies. The mode is vehicular and the person-trip purpose is attributed to specific modes including passenger-cars, regardless of whether they are owned or rented. Therefore, any additional assumptions of such services would be speculative at this time.

P69-30 The commenter requests clarifications regarding the assumptions made in calculating energy consumption. Energy use was estimated using the California Emissions Estimator Model. The energy usage rates are based on the 2016 California Green Building Standards Code (CALGreen; California Code of Regulations, Title 24, Part 11). Modifications to the model were incorporated to reflect the project's compliance with the latest 2019 California Green Building Standards Code and the project's energy-saving and sustainable design features. The model calculates energy use associated with the end uses of the building envelope (i.e., the heating, ventilation, and air conditions [HVAC] system; water heating system; and lighting). The model also includes estimates for appliances, electronics, and miscellaneous "plug-in" uses. The project does not propose an upgraded air filtration system, however, energy use associated with the project's HVAC system was considered. All model calculations are available in Appendix C, *Air Quality and Greenhouse Gas Impact Analysis*, of the Draft EIR.

P69-31 The commenter questions how many cubic yards of import and export would be required for project construction and whether it was included in the calculation of construction emissions and energy consumption. As detailed on page 5.2-21 of Draft EIR Section 5.2, *Air Quality*, project construction would require approximately 91,000 cubic yards of fill and 194,000 cubic yards of soil removal, totaling 103,000 cubic yards of export off-site. This information was utilized to model construction-related emissions and energy consumption; refer to Draft EIR Section 5.2, *Air Quality*, and Section 5.4, *Energy*.

P69-32 The commenter questions what additional sustainable development measures would be implemented by the proposed project aside from compliance with existing regulations. The project does not propose to meet LEED certification standards. However, as detailed on page 5.4-9 of Draft EIR Section 5.4, *Energy*, it would encourage sustainable design features to conserve energy and reduce greenhouse gas emissions, including, but not limited to:

- Limiting landscape irrigation when possible and incorporating drought-tolerant plant species and non-potable water sources;
- Installing green roofs, using alternative paving materials, and providing tree canopy shading;

- Installing solar ready rooftops;
- Utilizing recycled and reclaimed materials for surface parking areas, sidewalks, unit paving, and curbs;
- Incorporating permeable paving, low-glare and low-heat intensive surfaces; and
- Promoting stormwater retention through capture and harvest for re-use in landscaped areas.

P69-33 The commenter questions whether potential groundwater encountered during site excavation would be tested or disposed of properly. As detailed on page 5.8-17 in Draft EIR Section 5.8, *Hydrology and Water Quality*, it is likely that perched groundwater would be encountered during excavation. If groundwater is present above the proposed excavated bottom, the Preliminary Geotechnical Investigation indicates temporary dewatering would be required to maintain a safe working environment during excavation and construction activities. The Preliminary Geotechnical Investigation also recommends a qualified dewatering consultant be retained to design the dewatering system. Temporary dewatering may consist of perimeter wells with interior well points as well as gravel-filled trenches (French drains) placed adjacent to the shoring system and interior of the site. The French drains would direct the collected seepage to a sump where it would be pumped out and disposed. If dewatering discharge is piped to an infiltration basin during construction, the Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality (Order No. 2003-0003-DWQ) would be required pursuant to PPP HYD-5. If dewatering discharge is piped to storm drains, the requirements of the De Minimis Waste Discharge Requirements for the Santa Ana Region (Order No. R8-2015-0004, NPDES No. CAG998001) would govern dewatering activities during construction pursuant to PPP HYD-5. The potential dewatering permit is added to Chapter 3, *Errata*, of this Final EIR. Compliance with Order No. 2003-0003-DWQ/Order No. R8-2015-0004, NPDES No. CAG998001 would ensure project construction dewatering would not cause State waste discharge and Federal NPDES permit requirements to be exceeded.

The commenter also questions where the planned 19 modular wetlands would be located on-site. As shown on Draft EIR Figure 3-9, *Infrastructure Improvements – Storm Drain*, the modular wetlands are identified as green rectangular boxes and would not occupy significant portions of the open space area. The proposed modular wetlands and infiltration system would be installed underground and would not contain standing water on the surface. Thus, the proposed water quality treatment measures would not create breeding areas for mosquitoes.

P69-34 The commenter is concerned about the project's land use compatibility with adjacent industrial uses, including marijuana-related businesses allowed under Measure X. Section 5.9, *Land Use and Planning*, of the Draft EIR, analyzes the project's land use consistency with the General Plan and Zoning Code. The project site does not directly abut any true industrial uses including Measure X uses as Sunflower Avenue is to the north, SOCO is to the east, the I-405 Freeway is to the south, and an office building and associated surface parking lot is to the west.

2. Response to Comments

P69-35 The commenter requests an analysis of the project's open space, setbacks, and overall development intensity compared to other developments in the Harbor Gateway area. The proposed Specific Plan includes development standards that would apply specifically to the project site; refer to Table 3-4, *General Development Standards*, of the Draft EIR. These proposed development standards supersede the site's existing zoning requirements or standards applicable to other developments in the Harbor Gateway area. For the purposes of CEQA thresholds of significance, the project's proposed regulations pertaining to open space, setbacks, and overall development intensity, as it relates to the surrounding area, are considered throughout Draft EIR Section 5.0, *Environmental Analysis*, as relevant.

The project's precedent-setting actions are evaluated on page 10-3 of Draft EIR Chapter 10, *Growth-Inducing Impacts of the Proposed Project*.

P69-36 The commenter states that the Draft EIR does not analyze existing noise impacts associated with vehicular traffic along the I-405 Freeway on the proposed residences and open space area. Refer to response to comment P69-26 pertaining to consideration of the environment on the project.

The commenter also raises concerns regarding the fact that the Specific Plan does not apply the City's exterior noise standards to the project's common outdoor recreational amenity areas located on the ground level, including the open space area, and states that the Draft EIR must address the conflict between the Specific Plan and General Plan. The General Plan Noise Element establishes noise policies for the City. The Specific Plan does not conflict with the General Plan. A specific plan is intended to provide flexibility in the development of a specific area while implementing and being consistent with a general plan; however, it is not required to have the same development standards and regulations as the general plan or the underlying zoning. In addition, other mixed-use land uses, such as the westside urban plans that provide for similar setting of proximity of residential use to commercial or industrial uses, allow exemption of balconies and roof decks from exterior noise standards. For the purposes of General Plan consistency analysis, General Plan Goal N-2 states: "Noise and Land Use Compatibility. Integrate the known impacts of excessive noise on aspects of land use planning and siting of residential and non-residential projects." Further, Policy N-2.1 states: "Require the use of sound walls, berms, interior noise insulation, double-paned windows, and other noise mitigation measures, as appropriate, in the design of new residential or other new noise sensitive land uses that are adjacent to arterials, freeways, or adjacent to industrial or commercial uses." As analyzed in Draft EIR Section 5.10, *Noise*, project design is required to meet the noise standards included in the Specific Plan as well as 2019 Title 24 Standards, which would satisfy consistency with this policy.

The proposed Specific Plan, Section 3, *Development Standards*, includes a consistency analysis with the General Plan Noise Element (Specific Plan page 3-18). As discussed, the proposed project is designed to mitigate noise from Interstate-405 to the maximum extent possible. Residential units within a determined sensitive distance from Interstate-405 will contain sound mitigation construction techniques and materials as required by the City of Costa Mesa. Residential units closest to Interstate-405 are set back approximately 120 feet from the freeway right-of-way and are oriented facing away from the freeway and towards the project's internal courtyards and open spaces. Parking and a wall

2. Response to Comments

will provide separation between the residential building on the southerly portion of the community site and the freeway. Further, Draft EIR page 5.10-13 documents the required Standard Condition of Approval (SCA) C/I 42: "Prior to issuance of the first building permits, a detailed acoustical study based on architectural plans shall be prepared by a qualified acoustical consultant and submitted to Planning Division for review and approval. The study shall demonstrate compliance with noise standards as required by the Project Specific Plan and the City's General Plan. The acoustical study shall be prepared in compliance with the provisions of the California Administrative Code, Title 25, Chapter 1, Subchapter 1, Article 4. The applicant shall submit two copies of the study with the application for building permits. The acoustical analysis shall evaluate existing and projected noise levels, noise attenuation measures to be applied, and the noise insulation effectiveness of the proposed construction. The applicant shall demonstrate compliance with the recommendations of the acoustic analysis report prior to the issuance of building permits. The person preparing the report shall, under the direction of a person experienced in the field of acoustical engineering, perform an inspection of the project prior to or at the time of the framing inspection to certify that construction techniques comply with recommendations contained within the acoustical analysis. Upon completion of the subject structures, field tests may be required under the provisions of Title 25.

P69-37 The commenter raises concerns regarding construction-related noise impacts on adjacent uses and states that compliance with construction hour limits in the Municipal Code is not adequate to reduce such impacts. As shown in Draft EIR Table 5.10-4, *Existing Long-Term Noise Level Measurements*, , existing noise in the project vicinity is as high as 79.6 dBA CNEL. Construction noise levels are expected to be highest during site preparation/grading and building construction stages. Table 5.10-10, *Potential Construction Noise Impacts at Nearest Receptor*, of the Draft EIR, identifies that composite noise levels during construction at the nearest residential land uses to the south would reach 72.9 dBA L_{eq} and 80.4 dBA L_{eq} during the paving and building construction with pile driving stages, respectively. It is expected that composite noise levels during construction at the nearest commercial land uses to the east would reach 87.4 dBA L_{eq} and 90.1 dBA L_{eq} during the paving and building construction with pile driving stages, respectively. These predicted noise levels would only occur when all construction equipment is operating simultaneously at the closest point of construction and therefore, are conservative in nature. Further, as stated by the commenter, proposed construction activities are regulated by the Municipal Code. Specifically, construction activities would be allowed only between 7:00 a.m. and 7:00 p.m., Mondays through Fridays, and between 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted outside of these hours or on Sundays and specified Federal holidays, including New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (PPP N-2 and SCA CONST HRS-2). As construction-related noise impacts would remain below the 90 dBA L_{eq} and 100 dBA L_{eq} 1-hour construction noise level criteria as established by the Federal Transit Authority for residential and commercial land uses, respectively, construction-related noise impacts would be less than significant and no mitigation measures would be required, as described in the Draft EIR.

Further, the intent of Draft EIR Table 5.10-9, *Typical Construction Equipment Noise Levels*, is to provide a description of maximum instantaneous sound levels at 50 feet from the source; this does not equate to a compressor or generator running at 80 dB or an impact pile driver at over 100 dB all day long at the outdoor patio areas of SOCO. Construction is undertaken in discrete steps, each of which has its own mix of equipment, and, consequently, its own noise characteristics at different areas of the project site, depending on what activities are being undertaken. These various sequential stages would change the character of the noise generated on-site. Therefore, the noise levels vary as construction progresses. Additionally, typical operating cycles for these types of construction equipment may involve one to two minutes of full power operation followed by three to four minutes at lower power settings. Thus, it is false to assume people standing in the vicinity of the site during project construction activities would experience the maximum noise levels of the utilized construction equipment for the entire duration of construction.

P69-38 The commenter questions how the vibration threshold of 0.30 inches per second peak particle velocity (in/sec PPV) was selected to evaluate the project's vibration impacts. As detailed in Draft EIR Table 5.10-8, *Construction Vibration Damage Criteria*, construction vibration damage criteria are based on the Federal Transit Authority's *Transit Noise and Vibration Impact Assessment Manual*, and the 0.30 in/sec PPV threshold is applicable to engineered concrete and masonry buildings. As the closest structures to the project site are constructed from engineered concrete and masonry, the 0.30 in/sec PPV threshold was utilized in evaluating the project's construction vibration impacts.

Pile driving is anticipated to generate the greatest vibration of typical construction equipment with an upper range of approximately 1.518 in/sec PPV when measured at 25 feet; refer to Draft EIR Table 5.10-12, *Vibration Source Amplitudes for Construction Equipment*. The closest structures to the project site are approximately 85 feet from the proposed pile driving activities. At this distance, pile driving operations is estimated to generate groundborne vibration levels of up to 0.242 in/sec PPV and would not exceed the 0.3 in/sec PPV threshold. Thus, construction-related vibration impacts would be less than significant.

It is common practice to analyze a project's vibration impacts on structures rather than humans as impacts are very subjective and neither jurisdictions nor agencies have established vibration thresholds for adverse human impacts. On the other hand, the Federal Transit Authority's *Transit Noise and Vibration Impact Assessment Manual* is widely used to evaluate project-related vibration impacts on nearby structures under CEQA.

P69-39 The commenter questions what portion of the housing would be affordable to low and very low income households and requests that conditions of approval specify ongoing affordability and full integration of the affordable units into the project as a whole. As detailed in Chapter 3, *Project Description*, of the Draft EIR (page 3-8), the applicant is proposing to provide, at a minimum, 105 of the 1,057 units as affordable housing units. Although not a CEQA issue, the affordability level of the units and provisions related to integration and the term of the affordable units is included in the Development Agreement. The affordable units would remain affordable for 40 years and would not be separated or different from the project's market rate units.

2. Response to Comments

P69-40 The commenter misunderstands a statement in the Specific Plan stating that amenities would be provided in each of the residential buildings that are appropriate for all age groups. To clarify, the project is proposing to provide amenities for young and elderly residents, including swimming pools, high-tech gaming centers, bowling alley, fitness center, and spas and cabana areas. The project would not segregate residents by age.

P69-41 The commenter states that the proposed 1.5-acre open space is less than required by the General Plan. As detailed in Section 5.12, *Public Services and Recreation*, of the Draft EIR, the City has a goal to maintain a parkland standard of 4.26 acres of parkland per 1,000 residents. The project would need to provide 12.29 acres of parkland to meet this goal. This goal is implemented through the Municipal Code requirement for compliance with the Quimby Act and payment of park impact fees. The City requires the payment of a park impact fee to meet the parkland requirement (see PPP PS-1). The project would pay the entire park impact fee, as documented through the Development Agreement, thereby satisfying the City's parkland requirements. Payment of park impact fees is adequate mitigation for purposes of CEQA compliance. Beyond satisfying the City's park impact requirements, the project proposes to provide a 1.5-acre open space area and bicycle trail amenities, which would be permanently accessible to the public, as well as private, on-site amenities for project residents.

It should also be noted that the project would also include a number of recreational amenities for project residents, including a fitness center and wellness room; a club house/community room with a bowling alley, high-tech gaming center, kitchen/dining facilities, resort-style saltwater swimming pools (one Junior Olympic-size) with spas and cabana areas, multiple courtyards and rooftop amenity terraces, and community/art exhibit spaces. Additionally, the 1.5-acre open space available to the public would include seating and resting areas, creative landscaping/art pieces, shade structures, a trail connection to the Santa Ana River Trail to the west, and an active transportation hub that could include bicycle lockers, bicycle storage, bicycle repair facilities, and space for community-wide bicycle-share programs and events. The project also proposes major multimodal improvements along Sunflower Avenue to enhance the pedestrian and bicyclist experience and to connect to the regional Santa Ana River Trail system.

P69-42 The commenter questions whether the existing bicycle trail connection from Sunflower Avenue to the Santa Ana River Trail would be impeded during project construction and whether it would be fully accessible to the public at project completion. Refer to response to comment P69-13.

The commenter also questions whether visitors would be able to park on-site to access the "quasi-public open space" and whether the project would result in overflow parking south of the I-405 Freeway near Moon Park. Refer to response to comment P68-1 pertaining to available public parking areas on-site and along Sunflower.

P69-43 The commenter indicates that the existing LOS for study area intersections provided in the Draft EIR do not comport with reality, particularly along Harbor Boulevard and the I-405 on- and off-ramps, South Coast Drive, and Sunflower Avenue intersections during evening peak hours. As detailed in

Table 5.13-4, *Existing Level of Service Summary*, of the Draft EIR, these intersections would operate at a LOS B or C during p.m. peak hours.

P69-44 The commenter questions which haul routes within the City would be utilized for project construction and how impacts associated with anticipated lane closures would be reduced. Municipal Code Section 10-248, *Truck Routes*, states that trucks exceeding a maximum gross weight limit of 10,000 pounds are only permitted to drive on truck routes established and designated with appropriate signs. These include roadways designated as Major Arterials, including Newport Boulevard, Harbor Boulevard, Victoria Street, Baker Street, Adams Avenue, Fair Drive, West 19th Street, 17th Street, Placentia Avenue, Bear Street, Bristol Street, and Redhill Avenue.

As detailed in Draft EIR Section 5.13, *Transportation*, construction of the proposed project is not anticipated to require complete closures of any street. Construction activities would result in partial street closures on Sunflower Avenue on a temporary and intermittent basis to allow for construction activities such as roadway improvements and utility undergrounding/hook ups. Any lane closures require an encroachment permit and are subject to the review and approval of the City of Costa Mesa Transportation Division. The project would also be required to submit a Construction Management Plan that would include haul routes, staging areas, and site access that would minimize noise and traffic impacts to adjacent properties subject to review and approval by the City's Transportation Division. Additionally, per the City's Circulation Element, a detour would be required to be provided around the construction zone that would be designed to ensure the safety of cyclists and pedestrians (PPP T-1).

P69-45 The commenter states that the Draft EIR must address how narrowing Sunflower Avenue in the project vicinity would affect traffic flow both now and in the future. Existing traffic conditions do not assume a narrowed Sunflower Avenue as the proposed narrowing would not apply under existing conditions. As such, existing conditions were based on the current configuration of Sunflower Avenue. However, the narrowing of Sunflower Avenue is included in the future short-term (2027) cumulative plus project and General Plan buildout (2040) plus project traffic scenarios in the Draft EIR.

P69-46 The commenter asks whether the project's trip generation includes double trip ends in the immediate vicinity due to the use of ride sharing services. The trip generation for the project is based on the application of industry recognized and standard trip rates for the proposed land uses. These rates reflect the dynamism of productions and attractions and origins and destinations linking two trip purposes. The mode is vehicular and the person-trip purpose is attributed to specific modes, including passenger-cars, regardless of whether they are owned or rented.

P69-47 The commenter cites a paragraph from the Water Supply Assessment and questions whether the paragraph means existing water users would be expected to conserve water in order to meet the water demands of the proposed development. The concluding paragraph from the Water Supply Assessment (Draft EIR Appendix N, *Water Supply Assessment*, page 42) states that Mesa Water District would be able to accommodate existing and future water demands, including the proposed project. The subsequent sentence generally states that Mesa Water District has additional opportunities to increase water resources beyond existing supplies through extra groundwater capacity from existing wells and water conservation efforts and regulations.

P69-48 The commenter states the project has the potential to create precedent-setting actions for future high density developments to occur in the City. As stated in Chapter 10, *Growth-Inducing Impacts of the Proposed Project*, the approval of the proposed discretionary actions would not set a precedent that would make it more likely for other projects in the City to gain approval of similar applications. For example, a future project requesting to re-designate or rezone a site would need to undergo the same City review process as the proposed project, and CEQA environmental review and mitigate potentially significant environmental impacts on a project-level. The proposed approvals would only regulate future land development within the Specific Plan area by limiting permitted uses and requiring future development on-site to comply with development standards and design guidelines in the Specific Plan and Master Plan. While the project would result in the development of a mixed-use residential community in a predominantly industrial area, the site is also adjacent to existing retail and commercial uses (e.g., SOCO and The Mix) that would be compatible with the project's residential, creative office, specialty retail, and open space uses. Further, future projects with similar required discretionary actions would also be subject to applicable environmental review on a project-by-project basis. Implementation of the proposed project would not establish a procedure that would make future re-designations and/or rezones easier and would be speculative to determine any such effect. As such, the proposed project would not involve a precedent-setting action that could significantly affect the environment.

P69-49 The commenter requests that the City revise and recirculate the Draft EIR to address the issues raised in the comment letter. CEQA Guidelines Section 15088.5 requires a Lead Agency to "recirculate an EIR when significant new information is added to the EIR after public notice is given of the availability of the Draft EIR for public review under Section 15087 but before certification. New information added to an EIR is not 'significant' unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project's proponents have declined to implement." This comment letter and responses to the comments in this letter do not identify any significant new information requiring recirculation. As such, recirculation of the Draft EIR is not required.

P69-50 The commenter states that the Draft EIR is supposed to have the State Clearinghouse number on the title page. The inside cover title page is updated in Chapter 3, *Errata*, of this Final EIR.

COMMENT LETTER P70

From: C MT [mailto:cmtucholka@gmail.com]
Sent: Monday, March 30, 2020 4:26 PM
To: ASHABI, MINOO <MINOO.ASHABI@costamesaca.gov>; OMW Public Comments <OMWPublicComments@costamesaca.gov>
Subject: One Metro West Project - NO

No, thank you. We do not have the infrastructure nor the budget necessary to support this project - especially given the current state of affairs. This project is overambitious with unrealistic assumptions about traffic and parking. So - just NO. P70-1

P70. RESPONSES TO COMMENTS FROM C MT, MARCH 30, 2020.

P70-1 The commenter opposes the project stating the City does not have the infrastructure or budget to support the development and that the project is overambitious with unrealistic assumptions regarding traffic and parking. The project's traffic impacts are evaluated in Section 5.13, *Transportation*, of the Draft EIR, which concludes that the project would result in significant and unavoidable transportation impacts in regard to non-residential VMT and at two study area intersections and several freeway segments and ramps under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios. Given the significant and unavoidable impacts, a Statement of Overriding Considerations would be required to be made by the City per CEQA Guidelines Section 15093(b) in order to approve the project.

From: Lehua Coley <lehua@wearetrellis.com>
Sent: Tuesday, March 31, 2020 2:48 PM
To: ASHABI, MINOO
Subject: One Metro West Developement-

Dear Minoo Ashabi -

I am writing on behalf of One Metro West. I have been impressed by their level of involvement and commitment to the community and that their approach will add much needed housing for all types of Costa Mesa residents and those that work here while not changing the traditional neighborhoods many of our residents call home south of the 405 or near South Coast Metro.

In addition, by adding a new 1.5 acre open space on what is now a decades old industrial site, every member of the public can start to see how our community is better together which is one of the goals at Trellis that Rose Equities and the One Metro West community have worked to help make a reality.

Costa Mesa has an established, recognized need for housing and the approved and under development projects north of the 405 show that the need for housing will continue to grow. By approving One Metro West, Costa Mesa will be providing a realistic and positive solution for many residents, employers, and new employees looking for housing that does not require long work commutes or drives for shopping, restaurants, and entertainment. P71-1

Also, in light of the current Covid-19 situation and the likely economic impact that will have, I am strongly in favor of community focused developers who will continue to bring business into our community.

We look forward to continuing to support One Metro West in the future and appreciate your consideration of our thoughts.

Alohas,

Lehua Coley

Director of Development

TRELLIS | 949-422-0182

wearetrellis.com

P71. RESPONSES TO COMMENTS FROM LEHUA COLEY, MARCH 31, 2020.

P71-1 The commenter generally supports the proposed project, including the introduction of more housing and revitalization of an underutilized industrial site. The comment is acknowledged and no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Christine Palme <CPalme1@aol.com>
Sent: Monday, March 30, 2020 7:52 PM
To: ASHABI, MINOO
Subject: One Metro West

This email is to please beg of you not to go forward with the One Metro West project. P72-1

Thank you,
Christine Palme
Long time Mesa Verde resident (inner loop)

Sent from my iPhone

P72. RESPONSES TO COMMENTS FROM CHRISTINE PALME, MARCH 30, 2020.

P72-1 The commenter opposes the project but does not provide specific comments about the project's potential impacts or the adequacy of the Draft EIR analysis. No further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

March 19, 2020

Minoo Ashabi
Principal Planner
City of Costa Mesa

RE: Support for One Metro West

Dear Mrs. Ashabi,

I have been a resident of Costa Mesa since 2013 and am currently employed in Costa Mesa just 2 miles southeast of the proposed One Metro West project. I have also held positions as a CEQA & Planning consultant and am currently a member of People for Housing - OC.

My wife and I are both educated individuals with well-paying jobs and are among the hundreds of thousands of strained millennials confronted by the detrimental effects of the Housing Crisis. Outdated and subjective policies in Costa Mesa (i.e., Measure Y) have left this City starved for housing opportunities. Our policy- and NIMBY-driven Housing Crisis, the State's RHNA pressures, and the mass exodus of millennials from Orange County have proven that projects such as One Metro West MUST be welcomed in our City.

In addition, the economic center of our city, north of the 405, is nearly devoid of housing options. This means jobs are forced to be geographically separated from homes and local traffic and air quality impacts grow larger each day that housing is not built in Costa Mesa. As rightfully proven by the VMT analysis in the project's EIR (pg. 5.13-39), the project would produce a residential VMT that is 18% less than Orange County's Regional avg. P73-1

Unfortunately, the VMT analysis also concludes that the project would produce an office-related VMT that is 3% more than Orange County's Regional avg for office uses, and is therefore *significant* (pg 5.13-48). I understand the EIR is required to conclude this as a significant impact, but this is still a ridiculous Catch-22. If there was more housing in Costa Mesa near the One Metro West property under existing conditions, avg. employee commute lengths would have been lower in the project's traffic models, and the VMT "*caused by*" the proposed office would have likely come in lower than the regional avg. It's as if the development is being punished for the shortcomings of the City for not attracting housing to begin with.

We are in need of a healthy housing market with a plethora of market-rate, for-sale and for-rent opportunities; that is why I support the One Metro West project.

Thank You,

George Atalla
2250 Vanguard Way, Apt. G141
Costa Mesa, CA 92626
George.atalla@outlook.com

P73. RESPONSES TO COMMENTS FROM GEORGE ATALLA, MARCH 19, 2020.

P73-1 The commenter generally supports the proposed project, including the introduction of housing north of the I-405 Freeway. Although discussed, this comment does not specifically identify a concern with the adequacy of the Draft EIR. Therefore, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Jon & Patricia Rowe <rowboat9@yahoo.com>
Sent: Monday, March 30, 2020 7:57 PM
To: OMW Public Comments
Subject: NO on One Metro West

Follow Up Flag: Follow up
Flag Status: Completed

"As residents of Mesa Verde since 1998, we join the Mesa Verde Homeowners' Association in strongly objecting to the ONE METRO WEST Development Application. The density and location of the proposed development is inconsistent with sound planning practices, and will result in continuous gridlock of the Sunflower/Harbor/I-405/Gisler intersection complex, which is already graded "F". Please know that we will be voting against this development when it comes-up for approval under Measure Y requirements, should the Costa Mesa Planning Commission and/or Costa Mesa City Council green-light this folly. I submitted responses to the SARX study when that dumb idea threatened the quality of life in my neighborhood, and I will fight One Metro West just as ardently. P74-1

Cordially,

Jon B. Rowe
Patricia A. Rowe
1843 Gisler Ave., Costa Mesa, CA 92626

714-434-7785
rowboat9@yahoo.com

P74. RESPONSES TO COMMENTS FROM JON ROWE, MARCH 30, 2020.

P74-1 The commenter opposes the project stating that the project's density and location is inconsistent with sound planning practices and would result in traffic congestion at the Sunflower Avenue, Harbor Boulevard, I-405 Freeway, and Gisler Avenue intersection complex, which already operates at a LOS F. As discussed in the Draft EIR, traffic impacts associated with the project are considered in Section 5.13, *Transportation*, of the Draft EIR. As detailed in Draft EIR Table 5.13-4, *Existing Intersection Level of Service Summary*, the Harbor Boulevard/Sunflower Avenue (Study Intersection No. 10), Harbor Boulevard/I-405 Northbound Off-Ramp and I-405 Southbound On-Ramp (Study Intersection No. 12), Harbor Boulevard/I-405 Southbound Off-Ramp and I-405 Northbound On-Ramp (Study Intersection No. 13), and Harbor Boulevard/Gisler Avenue (Study Intersection No. 14) currently operate at a LOS C or better during a.m. and p.m. peak hours. Study Intersections No. 10 and No. 14 would result in less than significant impacts under existing plus project, future short-term cumulative (2027) plus project, and General Plan buildout (2040) plus project scenarios. However, the Draft EIR acknowledges that the Harbor Boulevard/I-405 north and southbound on- and off-ramps would result in significant and unavoidable impacts under existing plus project, future short-term cumulative (2027) plus project, and/or General Plan buildout (2040) plus project scenarios. Given the significant and unavoidable impacts, a Statement of Overriding Considerations would be required to be made by the City per CEQA Guidelines Section 15093(b) in order to approve the project.

From: Jan Giffard <j2784g@yahoo.com>
Sent: Monday, March 30, 2020 8:46 PM
To: OMW Public Comments
Subject: One Metro west

Follow Up Flag: Follow up
Flag Status: Completed

This is a very bad idea for our area we already have a lot of traffic in this area. These big developer should not be allowed to overcrowd the area with huge buildings this is not New York City!!! P75-1

P75. RESPONSES TO COMMENTS FROM JAN GIFFARD, MARCH 30, 2020.

P75-1 The commenter opposes the project stating that it would overcrowd the project area with large buildings, similar to New York City. This comment is not related to the adequacy of the Draft EIR analysis. Thus, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: Mary Spadoni <maryatsis@aol.com>
Sent: Monday, March 23, 2020 9:05 AM
To: PLANNING INFO <planninginfo@costamesaca.gov>
Subject: One Metro West Agenda Item

This agenda item is outrageous, it is attempting to get comments on the EIR, without any concrete plans, designs, or format. Where are the designs! How can you comment on a bunch of fluff with zero data? Is this a "grease the skids" program to hasten it's placement on the November ballot? How do you evaluate an EIR with "zero" real plans? Commissioners, I expect independent thinking from you all, questioning the total lack of real information and plans. Don't approve ghost plans that will affect our city in a major proportion. Ask the hard questions. P76-1

Be Safe, Stay Home

Sincerely,
Mary Spadoni

Sent from AOL Mobile Mail
Get the new AOL app: mail.mobile.aol.com

P76. RESPONSES TO COMMENTS FROM MARY SPADONI, MARCH 23, 2020.

P76-1 The commenter states that the Draft EIR has zero data and that there are no project plans, designs, or format. The full project description and an analysis of the project's potential environmental impacts are provided in the Draft EIR.

From: Sylvana Graham <sylvanagraham@gmail.com>
Sent: Monday, March 30, 2020 9:19 PM
To: ASHABI, MINOO
Subject: One metro west

To whom it may concern-

We do not want you to build 1057 units Near SOCO (condo and townhomes)
harbor blvd is already a disaster P77-1

Please consider not doing his building. Thank you

Sent from my iPhone

P77. RESPONSES TO COMMENTS FROM SYLVANA GRAHAM, MARCH 30, 2020.

P77-1 The commenter opposes the project stating that traffic along Harbor Boulevard is already too congested. This comment does not provide specific comments related to the adequacy of the Draft EIR analysis. As such, no further response is required as part of the CEQA process/CEQA response to comments. The comment has been provided to the City decisionmakers for consideration.

From: W Schallmo <billmyrealtor@yahoo.com>
Sent: Monday, March 30, 2020 6:52 PM
To: ASHABI, MINOO
Subject: One Metro West: NO,NO,NO,NO,NO,NO and NO!!!!!!!!!!!!!!!!!!

I have lived in the Mesa Verde (Lower Islands) track 25-years and happen to be a local Realtor. When I originally purchased my home, I was extremely happy that there were no "pass-through" traffic running through the actual neighborhood.

As I have marketed homes in the area, that has been a major selling feature that buyers have gravitated towards. This plan all but destroys that feature and turns a quite, peaceful and established neighborhood into another thoroughfare. P78-1

Keep in mind that our current governor wants to take away our cars and promote less single-trip road usage. Therefore the expense of the project would be lost on the fact that it's original purpose to lower traffic would be accomplished ergo the reduction of autos in the system.

Voting NO!

Respectfully,

William Schallmo
714.420.4425
Coldwell Banker Realty
REALTOR (R) BRE: 0083956
billmyrealtor@yahoo.com

P78. RESPONSES TO COMMENTS FROM WILLIAM SCHALLMO, MARCH 30, 2020.

P78-1 The commenter states that the project would adversely impact the established Mesa Verde neighborhood. The project site is located north of the I-405 Freeway greater than 200 feet north of the closest residence within the Mesa Verde neighborhood. The study intersections closest to the Mesa Verde neighborhood include Harbor Boulevard/Gisler Avenue (Study Intersection No. 14), Harbor Boulevard/Nutmeg Place (Study Intersection No. 15), and Harbor Boulevard/Baker Street (Study Intersection No. 16). As shown in Traffic Impact Analysis Figure 5-2, *Project Trip Distribution – Residential*, only one percent of outbound residential trips from the project site are anticipated to turn onto Gisler Avenue from Harbor Boulevard into the Mesa Verde neighborhood. No other inbound or outbound residential trips are anticipated to turn into the Mesa Verde neighborhood. Further, as shown on Figure 5-3, *Project Trip Distribution – Non-Residential*, only one percent of outbound non-residential trips from the project site are anticipated to turn onto Gisler Avenue and Nutmeg Place from Harbor Boulevard into the Mesa Verde neighborhood. No other inbound or outbound non-residential trips are anticipated to turn into the Mesa Verde neighborhood. Therefore, the neighborhood would not be converted into a thoroughfare to the proposed development as the roadways are all located south of the freeway and predominantly end in cul-de-sacs or loops within the neighborhood.

Chapter 3 Errata

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3. Errata

Changes to the Draft Environmental Impact Report (Draft EIR) are noted below. A double-underline indicates additions to the text; ~~strikethrough~~ indicates deletions to the text. Changes have been analyzed and responded to in Chapter 2, *Response to Comments*, of this Final EIR. The changes to the Draft EIR do not affect the overall conclusions of the environmental document. Changes are listed by page and, where appropriate, by paragraph.

These errata address the technical comments on the Draft EIR, which circulated from February 7, 2020 through March 23, 2020, and was extended to March 30, 2020 due to circumstances resulting from Governor Gavin Newsom's direction regarding COVID-19. These clarifications and modifications do not result in any new or substantially greater significant impacts as compared to those identified in the Draft EIR. Any changes referenced to mitigation measures contained in the Draft EIR text also apply to the Table of Contents, Chapter 1, *Executive Summary*, and Chapter 5, *Environmental Analysis*, of the Draft EIR. All mitigation measure modifications have been reflected in Chapter 4, *Mitigation Monitoring and Reporting Program*, of this Final EIR.

INSIDE COVER

Draft EIR insider cover (before page i)

One Metro West

State Clearinghouse No. 2019050014

ACRONYMS AND ABBREVIATIONS

Draft EIR page ii

CGS ....California Geological Survey
CH_4 ....Methane
CHRIS ....California Historical Resources Information System
CIPP ....Cured-in-place Pipe
City ....City of Costa Mesa
CMFD ....Costa Mesa Fire & Rescue Department
CMP ....Congestion Management ~~Plan~~Program
CMPD ....Costa Mesa Police Department
CMSD ....Costa Mesa Sanitary District
CNEL ....Community Noise Equivalent Level

EXECUTIVE SUMMARY

Draft EIR page 1-14

SCA FIRE-15 The applicant shall provide approved smoke detectors to be installed in accordance with the latest edition of the ~~Uniform~~ California Fire Code.

SCA FIRE-16 The applicant shall provide an approved automatic extinguishing system for all commercial cooking surfaces, hoods, and ducts.

CHAPTER 3, PROJECT DESCRIPTION

Draft EIR page 3-11, Table 3-4, General Development Standards

Table 3-4 General Development Standards

Building Setbacks	
Perimeter	
Sunflower Avenue	10 feet
I-405 Freeway (Residential Building)	10 feet
I-405 Freeway (Creative Office Building)	5 feet
East Property Line (adjacent to SOCO)	10 feet
West Property Line	10 feet
Internal	
Center Line of Fire Lanes (Residential)	10 feet
Creative Office/Open Space	0 feet
Maximum Building Heights	
Residential Buildings	7 stories (98 feet)
Creative Office Building	3 stories (52 feet)
Parking	
Residential	1.30 spaces per unit~~ / 0.89 spaces per bedroom~~
Non-Residential	4 spaces per 1,000 square feet
Amenities	
Minimum Indoor Amenities (Entire Site)	54,500 square feet
Minimum Outdoor Amenities (Entire Site)	32,800 square feet

Source: Rose Equities 2019.

Draft EIR page 3-9, Creative Office

Creative Office

The proposed creative office building would occupy a three-story, 25,000-square-foot building with accessible parking spaces at-grade and shared parking with Building A~~at-grade parking~~. Permitted uses within the creative office space component include professional services, such as advertising, business management, engineering, landscaping architecture, and other service uses.

Draft EIR page 3-9, Table 3-3, Permitted and Conditionally Permitted Uses

Table 3-3 Permitted and Conditionally Permitted Uses

Use	Permitted	Conditionally Permitted
General		
Mixed-Use Developments	X	
Home Occupations that do not involve more than one customer/client at a time	X	
Public Events, including City-sponsored events, in conjunction with open space area	X	
Temporary Real Estate and Construction Offices	X	
Community Clubs (for residents only)	X	
Civic Clubs (for residents and public use)	X	
Off-Street Parking Areas and Structures	X	
Bowling Alley (for residents only)	X	
Physical Fitness Facility (for residents only)	X	
Food Trucks		MC
Residential		
Multi-Family Residences	X	
General Offices/Professional Offices		
Administrative	X	
Advertising Agency	X	
Attorney	X	
Business Management/Consultant	X	
Detective Agency	X	
Economist	X	
Employment Agency	X	
Engineer and Surveyor	X	
Insurance Broker	X	
Landscape Architect	X	
Psychologist	X	
Public Accountant	X	
Public Relations Consultant	X	
Real Estate Broker	X	
Service Offices (e.g., bookkeeping and data processing)	X	
Commercial		
Antique Store	X	
Art Shop/Gallery	X	
Artist Studio	X	
Bakery (Retail)	X	
Barbershop	X	
Beauty Shop	X	
Bicycle Shop	X	
Specialty Grocery Store and/or Neighborhood Bar		MC
Bookstore	X	
Clothing/Apparel Store	X	
Coffeehouse		MC
Commercial Art/Graphic Design	X	
Convenience Store	~~X~~	MC
Dry Cleaner		MC
Florist Shop/Flower Stand	X	
Ice Cream/Frozen Yogurt Shop (with more than 300 square feet of public area)		MC
Jewelry Store	X	
Outdoor Dining (within Commercial area of project site only)		MC
Pet Shop		MC
Photographer Studio	X	

3. Errata

Use	Permitted	Conditionally Permitted
Tailor Shop	X	
Recreational		
~~Playground~~	~~X~~	
Small Performance Area (in conjunction with open space area)	X	

Source: Rose Equities 2019.
MC = Minor Conditional Use Permit; uses listed under Conditionally Permitted subject to MCUP review process.

Draft EIR page 3-15, Table 3-5, Proposed Parking Plan

Table 3-5 Proposed Parking Plan

Area	Buildout	Parking Ratio~~[1]~~	Parking Demand	Parking Supply
Building A				
Dwelling Units	449	1.3 per dwelling units	584	
~~Bedrooms~~	~~648~~	~~0.89 per bedroom~~	~~577~~	
Office[~~2~~1]	25,000 SF	4.0 per 1,000 SF	100	
Total Building A			*684*	*825*
Building B				
Dwelling Units	379	1.3 per dwelling units	493	
~~Bedrooms~~	~~544~~	~~0.89 per bedroom~~	~~484~~	
Total Building B			*493*	*668*
Building C				
Dwelling Units	229	1.3 per dwelling units	298	
~~Bedrooms~~	~~347~~	~~0.89 per bedroom~~	~~309~~	
Retail	6,000 SF	4.0 per 1,000 SF	24	
Total Building C			*~~333~~ 322*	*421*
Total Entire Site			**~~1,510~~ 1,499**	**1,914**

Source: LSA 2019e.
Notes: SF = square feet~~; Bold indicates the higher calculation and the parking demand to be accommodated.~~
~~1 Per the parking study completed by LSA, the proposed parking rate is 0.89 per bedroom or 1.3 spaces per dwelling unit, whichever is greater.~~
~~2~~1 Building A parking structure would dedicate 35 parking spaces for the office building. The remaining required parking spaces for the office building will be shared with the residential in Building A parking structure at the ground level.

Draft EIR page 3-26, Creative Office Building

Creative Office Building

The 25,000-square foot creative office building is proposed in the westernmost corner of the project site, adjacent to the I-405 Freeway and south of the proposed open space. The three-story creative office building would have a maximum building height of 52 feet and utilize shared parking spaces within Building A.

According to the Master Plan, a six-foot block wall with vines would be constructed along the eastern project boundary adjacent to SOCO~~ and an approximately 12-foot block sound wall would be constructed along the project edge facing the I-405 Freeway. The location, material, and design of the sound wall would be determined with construction documents and may be incorporated into the building structures as feasible~~. The conceptual open space plan, conceptual private open space plan, fence and wall plan, public and private open space art plan, and lighting plan are also included in the Master Plan.

Draft EIR page 3-26, Section 3.4.2, Project Construction Timeline

3.4.2 Project Construction Timeline

Construction is expected to commence in one phase, over a period of five years, from January 2022 to January 2027. Construction of the on-site buildings would likely occur in the following order: Building A and open space, Building B, Building C, then the creative office building. First occupancy is anticipated in 2027 ~~in 2025,~~ ~~with~~ or when final construction is completed ~~by 2027~~. There will be no occupancy until the project has completed all construction.

Draft EIR page 3-27, Intended Uses of the EIR

Agency	Action
City of Costa Mesa	▪ Certification of the EIR ▪ Approval of the General Plan Amendment ▪ Approval of the Zone Change ▪ Adoption of the Specific Plan ▪ Adoption of the Master Plan ▪ Approval of the Development Agreement ▪ Approval of the Tentative Tract Map ▪ Approval of Tree Removal Permit ▪ Approval of Public Art Plan
California Public Utilities Commission	▪ Approval of General Order 131D and Section 851 (Transfer or Encumbrance of Utility Property)
Orange County Flood Control District (OCFCD)	▪ Issuance of an Encroachment Permit within OCFCD right-of-way
Santa Ana Regional Water Quality Control Board	▪ Issuance of a National Pollution Discharge Elimination System (NPDES) Permit ▪ Issuance of a Dewatering Permit, if needed
Orange County Sanitation District	▪ Approval of proposed sewer improvements
Costa Mesa Sanitary District	▪ Approval of proposed sewer improvements
Orange County Airport Land Use Commission	▪ Determination of Consistency with Airport Environs Land Use Plan for John Wayne Airport
City of Fountain Valley	▪ Implementation of recommended Mitigation Measure T-2 regarding traffic improvements
California Department of Transportation (Caltrans)	▪ Issuance of Encroachment Permit within Caltrans right-of-way, if needed ▪ Consultation regarding construction activities

SECTION 5.1, AESTHETICS

Draft EIR page 5.1-21, Shade/Shadow Analysis

Shade/Shadow Analysis

In order to identify the proposed project's potential increase in shadow-related impacts, morning, noon, afternoon, and evening shade patterns were compared for the proposed project. Specifically, four dates were used for analysis purposes: the winter solstice (December 21), when the sun is at its lowest; the summer solstice (June 21), when the sun is at its highest; and the vernal and autumnal equinoxes (March 21 and September 21), when day and night are of approximately equal length. The longest shadows are cast during the winter months, and the shortest shadows are cast during the summer months. The following discussion describes the project's potential to result in shadow-related impacts during the summer/winter solstices and vernal/autumnal equinoxes. Note that the analysis considers shadow effects associated with proposed building massing only; the shadow patterns associated with proposed landscaping are not addressed.

The project's shade/shadow patterns throughout the year are generally described in Figure 5.1-2 through Figure 5.1-5, *Proposed Shade/Shadow Patterns*. As illustrated, the only areas that would be substantially shaded include SOCO and Sunflower Avenue right-of-way in the fall~~,~~ and winter~~, and spring~~ months. However, these areas are not considered shadow sensitive. Implementation of the proposed project would not result in any significant shading of light-sensitive uses (uses where sunlight is important for function). Therefore, impacts would be less than significant.

Draft EIR page 5.1-30, Mitigation Measure AE-1

AE-1 Prior to the issuance of the first building permit, the City's Development Services Department shall verify that the Applicant's Lighting Plan and Photometric Study prepared as part of SCA AE-5 demonstrates compliance with the following:

- The mounting height of lights on light standards shall not exceed 18 feet in any location on the project site unless approved by the Development Services Director.
- Rooftop lighting shall include cutoff optics to ensure lighting is aimed downward and does not contribute to sky brightness or skyglow.
- Parking structure lighting shall use shielding techniques to focus light into the parking lot areas and screen light from spilling to off-site areas, eliminating light trespass. ~~Illumination levels shall not exceed 100 candelas per meter squared.~~
- The parking structure facade artistic treatment shall include light shields or baffles to eliminate glare to travelers along to I-405 Freeway.
- Exterior building lighting shall not exceed the Caltrans maximum brightness of 350 candelas per meter squared as measured from the adjacent freeway shoulder.

SECTION 5.5, GEOLOGY AND SOILS

Draft EIR page 5.5-16, Mitigation Measure GEO-2

GEO-2 Excavation and grading activities in deposits with high paleontological sensitivity shall be monitored by a qualified paleontological monitor following a PRIMP. No paleontological monitoring is required for activities in artificial fill or the young alluvial fan deposits from the surface to a depth of ten feet below ground surface (bgs~~)~~. If paleontological resources are encountered during the course of ground disturbance activities, the paleontological monitor shall have the authority to temporarily redirect construction away from the area of the find in order to assess its significance. In the event paleontological resources are encountered when a paleontological monitor is not present, work in the immediate area of the find shall be redirected, and a paleontologist shall be contacted to assess the find for significance. If determined to be significant, the fossil shall be collected from the field.

SECTION 5.6, GREENHOUSE GAS EMISSIONS

Draft EIR page 5.6-15, Mitigation Measure GHG-1

GHG-1 Prior to issuance of a building permit, the City's Planning Division shall verify that the applicant has designed the proposed parking areas to provide preferential parking for low-emitting, fuel-efficient, and carpool/van vehicles. At a minimum, the number of electric vehicle (EV) charging stations shall be equal to Tier 2 Nonresidential Voluntary Measures of the California Green Building Standards Code Section A5.106.5.1.2.

SECTION 5.7, HAZARDS AND HAZARDOUS MATERIALS

Draft EIR page 5.7-7, California Fire Code

California Fire Code

The ~~2013~~ 2019 California Fire Code (CCR Title 24 Part 9) sets requirements pertaining to fire safety and life safety, including for building materials and methods, fire protection systems in buildings, emergency access to buildings, and handling and storage of hazardous materials.

Draft EIR page 5.7-8, City of Costa Mesa Fire Prevention Program

City of Costa Mesa Fire & Rescue Community Risk Reduction ~~Prevention~~ Program

The City of Costa Mesa Fire & Rescue Community Risk Reduction ~~Prevention~~ Program develops and enforces local fire, life safety, property, and environmental protection standards; enforces State-adopted fire and life safety codes; reviews building construction plans; conducts building construction and business inspections; investigates citizen complaints; manages the City's hazardous materials disclosure program; provides training to department personnel in regard to fire and life safety codes; and assists professional trades with technical fire code requirements and department public education efforts (Costa Mesa 2019c).

Draft EIR page 5.7-20, Mitigation Measure HAZ-2

HAZ-2 Contractors shall be responsible for the health and safety of their own employees and are required to have their own Health and Safety Plan (HSP) and Injury and Illness Prevention Plans (IIPPs) to comply with OSHA. The HSP and IIPPs must be submitted to the Development Services Department prior to the issuance of a grading or demolition permit. The copy of the plan(s) must also be~~The HSPs shall provide health and safety guidance such that field activities can be conducted in a safe manner. The plan must be~~ kept on site during any soil disturbance and hauling activities, if required.

SECTION 5.12, PUBLIC SERVICES AND RECREATION

Draft EIR page 5.12-11, Section 5.12.3, Plans, Programs, Policies and Standard Conditions of Approval

PPP FS-1 The proposed project is required to comply with the latest edition of the ~~2019 edition of the~~ California Fire Code.

3. Errata

Draft EIR page 5.12-12, Section 5.12.3, Plans, Programs, Policies and Standard Conditions of Approval

SCA FIRE-15 The applicant shall provide approved smoke detectors to be installed in accordance with the latest edition of the ~~Uniform~~ California Fire Code.

SCA FIRE-16 The applicant shall provide an approved automatic extinguishing system for all commercial cooking surfaces, hoods, and ducts.

Draft EIR page 5.12-14, Impact 5.12-1

The City's demands on CMFD's services would be offset through the collection of development impact fees established based on the Costa Mesa Fire Protection System Fee Study, the proportional increase in the City's General Fund through taxes (or other similar revenues) generated by the project, and/or as required per the Development Agreement and Municipal Code Section 13-270, *Establishment of Development Impact Fee* (PPP FS-3). The project would also be subject to SCA FIRE-7, -8, -14, -15, -17, and -25, requiring the installation of onsite fire hydrants, fire extinguishers, smoke detectors, and fire sprinkler systems in accordance with National Fire Protection Association and ~~Uniform~~ California Fire Code requirements. SCA FIRE-16 requires installation of an automatic extinguishing system for all commercial cooking surfaces, hoods, and ducts in residential kitchens, and SCA FIRE-9 and -10 require the project's water improvement plans be reviewed and approved by CMFD, including required fire flow and pressure. Prior to the issuance of building permits, SCA FIRE-26 requires the applicant to participate in the upgrading of fire protection facilities as requested by the City. Additionally, SCA FIRE-13 requires fire access roads to be adequately sized to provide proper fire truck access to on-site fire hydrants. Overall, the final project plans would be reviewed and approved by the CMFD, which would ensure adequate emergency access, fire hydrant availability, and compliance with all applicable State and local codes and standards.

SECTION 5.13, TRANSPORTATION

Draft EIR page 5.13-2

Orange County Transportation Authority Congestion Management ~~Plan~~Program

The Orange County Transportation Authority (OCTA) is the subregional planning agency for Orange County. In June 1990, the Proposition 111 gas tax increase required California's urbanized areas (areas with populations of 50,000 or more) to adopt a Congestion Management Program (CMP). The CMP is intended to link transportation, land use, and air quality decisions and to address the impact of local growth on the regional transportation system. Compliance with CMP requirements ensures a city's eligibility to compete for State gas tax funds for local transportation projects. The Orange County CMP was established in 1991, and the most recent CMP was adopted in 2017. An updated CMP was considered by the OCTA Board of Directors on November 25, 2019 and is currently being considered by SCAG for a finding of regional consistency (OCTA 2019a).

CHAPTER 11, ORGANIZATIONS AND PERSONS CONSULTED

Draft EIR page 11-1, Fire Department

Fire Department

Dan Stefano, Fire Chief
Jon Neal, ~~Assistant~~ Fire Marshal

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Chapter 4 Mitigation Monitoring and Reporting Program

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4. Mitigation Monitoring And Reporting Program

The California Environmental Quality Act (CEQA) requires that when a public agency completes an environmental document which includes measures to mitigate or avoid significant environmental effects, the public agency must adopt a reporting or monitoring program. This requirement ensures that environmental impacts found to be significant will be mitigated. The reporting or monitoring program must be designed to ensure compliance during project implementation (Public Resources Code Section 21081.6).

In compliance with Public Resources Code Section 21081.6, Table 4-1, *Mitigation Monitoring and Reporting Checklist*, has been prepared for the One Metro West Project (project). This Mitigation Monitoring and Reporting Checklist is intended to provide verification that all applicable mitigation measures relative to significant environmental impacts are monitored and reported. Monitoring will include: 1) verification that each mitigation measure has been implemented; 2) recordation of the actions taken to implement each mitigation; and 3) retention of records in the City of Costa Mesa One Metro West Project file.

This Mitigation Monitoring and Reporting Program (MMRP) delineates responsibilities for monitoring the project, but also allows the City of Costa Mesa (City) flexibility and discretion in determining how best to monitor implementation. Monitoring procedures vary according to the type of mitigation measure. Adequate monitoring consists of demonstrating that monitoring procedures took place and that mitigation measures were implemented. This includes the review of all monitoring reports, enforcement actions, and document disposition, unless otherwise noted in the Mitigation Monitoring and Reporting Checklist (Table 4-1). If an adopted mitigation measure is not being properly implemented, the designated monitoring personnel shall require corrective actions to ensure adequate implementation.

Reporting consists of establishing a record that a mitigation measure is being implemented, and generally involves the following steps:

- The City distributes reporting forms to the appropriate entities for verification of compliance.
- Departments/agencies with reporting responsibilities will review the Draft EIR and Final EIR, which provide general background information on the reasons for including specified mitigation measures.
- Problems or exceptions to compliance will be addressed to the City as appropriate.
- Periodic meetings may be held during project implementation to report on compliance of mitigation measures.
- Responsible parties provide the City with verification that monitoring has been conducted and ensure, as applicable, that mitigation measures have been implemented. Monitoring compliance may be

documented through existing review and approval programs such as field inspection reports and plan review.

- The City prepares a reporting form periodically during the construction phase for all project mitigation monitoring efforts.

- Appropriate mitigation measures will be included in construction documents and/or conditions of permits/approvals.

Minor changes to the MMRP, if required, must be made in accordance with CEQA and would be permitted after further review and approval by the City. No change is permitted unless the MMRP continues to satisfy the requirements of Public Resources Code Section 21081.6.

4. Mitigation Monitoring And Reporting Program

Table 4-1
Mitigation Monitoring and Reporting Checklist

Mitigation Number	Mitigation Measure	Implementation Responsibility	Timing	Monitoring Responsibility	Timing	VERIFICATION OF COMPLIANCE		
						Initials	Date	Remarks
5.1 AESTHETICS								
AE-1	Prior to the issuance of the first building permit, the City's Development Services Department shall verify that the Applicant's Lighting Plan and Photometric Study prepared as part of SCA AE-5 demonstrates compliance with the following: ▪ The mounting height of lights on light standards shall not exceed 18 feet in any location on the project site unless approved by the Development Services Director. ▪ Rooftop lighting shall include cutoff optics to ensure lighting is aimed downward and does not contribute to sky brightness or skyglow. ▪ Parking structure lighting shall use shielding techniques to focus light into the parking lot areas and screen light from spilling to off-site areas, eliminating light trespass. ▪ The parking structure facade artistic treatment shall include light shields or baffles to eliminate glare to travelers along to I-405 Freeway. ▪ Exterior building lighting shall not exceed the Caltrans maximum brightness of 350 candelas per meter squared as measured from the adjacent freeway shoulder.	Project Applicant	During Lighting Plan and Photometric Study Review; Prior to Issuance of First Building Permit	City Development Services Department	During Lighting Plan and Photometric Study Review; Prior to Issuance of First Building Permit			

Mitigation Number	Mitigation Measure	Implementation Responsibility	Timing	Monitoring Responsibility	Timing	VERIFICATION OF COMPLIANCE		
						Initials	Date	Remarks
5.2 AIR QUALITY								
AIR-1	Prior to the issuance of a grading permit, the grading plans shall stipulate that the contractor shall use construction equipment that meets the U.S. Environmental Protection Agency Tier 3 level of emission controls fitted with Level 2 Diesel Particulate Filters (DPF) for all construction equipment 50 horsepower or more during construction activities.	Project Applicant; Construction Contractor	Prior to Issuance of Grading Permit; During Construction Activities	City Development Services Department	Prior to Issuance of Grading Permit; During Construction Activities			
AIR-2	The project contractor shall only use interior paints with low VOC content with a maximum concentration of 30 grams per liter (g/L) for residential building architectural coating to reduce VOC emissions. All building and site plans shall note use of paints with a low VOC content with a maximum concentration of 30 g/L verified by the City of Costa Mesa prior to issuance of a building permit and during interior coating activities.	Project Applicant; Construction Contractor	Prior to Issuance of Building Permit; During Interior Coating Activities	City Development Services Department	Prior to Issuance of Building Permit; During Interior Coating Activities			
5.3 CULTURAL RESOURCES								
CUL-1	Prior to issuance of any grading permits, the City of Costa Mesa shall ensure a qualified archaeologist who meets the Secretary of the Interior's Standards for professional archaeology has been retained for the project and shall be on-call during all demolition and grading/excavation. The qualified archaeologist shall ensure the following measures are followed for the project: ▪ Prior to any ground disturbance, the qualified archaeologist, or their designee, shall provide worker environmental awareness protection training to construction personnel regarding regulatory requirements for the protection of cultural (prehistoric and historic)	Project Applicant; Construction Contractor; Qualified Archaeologist	Prior to Issuance of Grading Permit; Prior to and During Ground Disturbing Activities	City Development Services Department	Prior to Issuance of Grading Permit; Prior to and During Ground Disturbing Activities			

4. Mitigation Monitoring And Reporting Program

Mitigation Number	Mitigation Measure	Implementation Responsibility	Timing	Monitoring Responsibility	Timing	VERIFICATION OF COMPLIANCE		
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	resources. As part of this training, construction personnel shall be briefed on proper procedures to follow should unanticipated cultural resources be discovered during construction. Workers shall be provided contact information and protocols to follow in the event that inadvertent discoveries are made. The training can be in the form of a video or PowerPoint presentation. Printed literature (handouts) can accompany the training and can also be given to new workers and contractors to avoid the necessity of continuous training over the course of the project. ▪ Prior to any ground disturbance, the applicant shall submit a written Project Monitoring Plan (PMP) to the City's Development Services Director for review and approval. The monitoring plan shall include monitor contact information, specific procedures for field observation, diverting and grading to protect finds, and procedures to be followed in the event of significant finds. ▪ In the event unanticipated cultural material is encountered during any stage of project construction, all construction work within 50 feet (15 meters) of the find shall cease and the qualified archaeologist shall assess the find for importance. Construction activities may continue in other areas. If the discovery is determined to not be important by the qualified archaeologist, work shall be permitted to continue in the area. ▪ If warranted based on the qualified							

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	archaeologist's evaluation of the find, the archaeologist shall collect the resource and prepare a test-level report describing the results of the investigation. The test-level report shall evaluate the site including discussing the significance (depth, nature, condition, and extent of the resource), identifying final mitigation measures the City's Development Services Director shall verify are incorporated into future construction plans, and providing cost estimates. ▪ If the qualified archaeologist determines that the find is prehistoric or includes Native American materials, affiliated Native American groups shall be invited to contribute to the assessment and recovery of the resource, as applicable. The qualified archaeologist and any applicable Native American contacts shall collect the resource and prepare a test-level report describing the results of the investigation. The test-level report shall evaluate the site including discussion of significance (depth, nature, condition, and extent of the resources), final mitigation recommendations, and cost estimates. ▪ Salvage operation requirements pursuant to Section 15064.5 of the CEQA Guidelines shall be followed. Work within the area of discovery shall resume only after the resource has been appropriately inventoried, documented, and recovered, as applicable.							

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5.5 GEOLOGY AND SOILS								
GEO-1	The project applicant shall retain a qualified paleontologist to develop a Paleontological Resources Impact Mitigation Program (PRIMP) for this project. The PRIMP shall be consistent with the guidelines of the Society of Vertebrate Paleontology and include the methods that shall be used to protect paleontological resources that may exist within the project area, as well as procedures for monitoring, fossil preparation and identification, curation into a repository, and preparation of a report at the conclusion of grading. A copy of the PRIMP shall be submitted to the Development Services Department prior to the issuance of a grading permit.	Project Applicant; Qualified Paleontologist	Prior to Issuance of Grading Permit	City Development Services Department	Prior to Issuance of Grading Permit			
GEO-2	Excavation and grading activities in deposits with high paleontological sensitivity shall be monitored by a qualified paleontological monitor following a PRIMP. No paleontological monitoring is required for activities in artificial fill or the young alluvial fan deposits from the surface to a depth of ten feet below ground surface (bgs). If paleontological resources are encountered during the course of ground disturbance activities, the paleontological monitor shall have the authority to temporarily redirect construction away from the area of the find in order to assess its significance. In the event paleontological resources are encountered when a paleontological monitor is not present, work in the immediate area of the find shall be redirected, and a paleontologist shall be contacted to assess the find for significance. If determined to be significant, the fossil shall be collected from the field.	Qualified Paleontological Monitor; Construction Contractor	During Ground Disturbing Activities	City Development Services Department	During Ground Disturbing Activities			

Mitigation Number	Mitigation Measure	Implementation Responsibility	Timing	Monitoring Responsibility	Timing	VERIFICATION OF COMPLIANCE		
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GEO-3	If paleontological resources are determined to be significant by the qualified paleontologist, the collected paleontological resources shall be prepared to the point of identification, identified to the lowest taxonomic level possible, cataloged, and curated into the permanent collections of a museum repository. At the conclusion of the monitoring program, a report of findings shall be prepared by the qualified paleontologist to document the results of the monitoring program, and a copy of the report shall be provided to the Development Services Department.	Qualified Paleontologist	During Ground Disturbing Activities; After Conclusion of Monitoring Program	City Development Services Department	During Ground Disturbing Activities; After Conclusion of Monitoring Program			
5.6 GREENHOUSE GAS EMISSIONS								
GHG-1	Prior to issuance of a building permit, the City's Planning Division shall verify that the applicant has designed the proposed parking areas to provide preferential parking for low-emitting, fuel-efficient, and carpool/van vehicles. At a minimum, the number of electric vehicle (EV) charging stations shall be equal to Tier 2 Nonresidential Voluntary Measures of the California Green Building Standards Code Section A5.106.5.1.2.	Project Applicant	Prior to Issuance of Building Permit	City Development Services Department Planning Division	Prior to Issuance of Building Permit			
GHG-2	Prior to issuance of a building permit, the City's Building Division shall verify that the applicant has designed the proposed parking areas to provide electric vehicle (EV) charging stations. At a minimum, the number of EV charging stations shall be equal to the Tier 2 Nonresidential Voluntary Measures of the California Green Building Standards Code Section A5.106.5.3.2.	Project Applicant	Prior to Issuance of Building Permit	Building Safety Division	Prior to Issuance of Building Permit			
5.7 HAZARDS AND HAZARDOUS MATERIALS								
HAZ-1	Prior to issuance of a grading permit, the Soils Management Plan (SMP) (prepared by Geocon	Project Applicant;	Prior to Issuance of	City Engineer	Prior to Issuance of			

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	Incorporated, dated July 24, 2019) shall be made available to the contractor and City Engineer for use prior to and during grading activities. The following Performance Criteria shall be incorporated into the SMP prior to issuance of a grading permit: ▪ Site-specific health and safety requirements, pre-field activities, site control, excavation of impacted soil, dust and erosion control, air monitoring, decontamination, field documentation and confirmation soil sampling shall be implemented under the oversight of a licensed professional geologist or engineer and the appropriate regulatory oversight agencies (including DTSC and Santa Ana RWQCB) shall be notified, as required by law; ▪ If contaminated soil is encountered, the appropriate regulatory oversight agencies (e.g., DTSC, RWQCB, OCHCA) shall be notified; ▪ Soil sampling shall follow the protocols outlined in the DTSC Preliminary Endangerment Assessment Guidance Manual dated October 2015; and ▪ Soil import/export verification sampling shall be conducted by a qualified environmental professional to confirm the presence or absence of hazardous materials prior to hauling off-site. Proof of verification sampling shall be provided to the City Engineer prior to import/export. In the event potential contamination is encountered, the contamination shall be evaluated by the qualified environmental professional using	Construction Contractor	Grading Permit; Prior to and During Grading Activities		Grading Permit; Prior to and During Grading Activities			

Mitigation Number	Mitigation Measure	Implementation Responsibility	Timing	Monitoring Responsibility	Timing	VERIFICATION OF COMPLIANCE		
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	appropriate collection and sampling techniques as determined by the appropriate regulatory oversight agency (e.g., DTSC, RWQCB, OCHCA). The nature and extent of contamination shall be determined and the appropriate handling, disposal, and/or treatment shall be implemented in accordance with applicable regulatory requirements.							
HAZ-2	Contractors shall be responsible for the health and safety of their own employees and are required to have their own Health and Safety Plan (HSP) and Injury and Illness Prevention Plans (IIPPs) to comply with OSHA. The HSP and IIPPs must be submitted to the Development Services Department prior to the issuance of a grading or demolition permit. The copy of the plan(s) must also be kept on site during any soil disturbance and hauling activities, if required.	Construction Contractor	During Construction Activities; Prior to Issuance of Grading or Demolition Permit	City Development Services Department	During Construction Activities; Prior to Issuance of Grading or Demolition Permit			
HAZ-3	At least three business days prior to any lane closure, the construction contractor shall notify the Costa Mesa Police Department and Costa Mesa Fire Department, along with the City of Costa Mesa Public Services Director, of construction activities that would impede movement (such as road or lane closures), to allow for uninterrupted emergency access of evacuation routes.	Construction Contractor	At Least Three Business Days Prior to Any Lane Closure	Costa Mesa Police Department; Costa Mesa Fire & Rescue Department; City Public Services Department	At Least Three Business Days Prior to Any Lane Closure			
5.12 PUBLIC SERVICES AND RECREATION								
PS-1	Prior to issuance of the first occupancy permit, the applicant shall provide written documentation to the City of Costa Mesa Development Services Department that the existing traffic signals along the response corridors from Costa Mesa Fire &	Project Applicant	Prior to Issuance of First Occupancy Permit	City Development Services Department; Costa Mesa Fire	Prior to Issuance of First Occupancy Permit			

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	Rescue Department (CMFD) Stations 1, 2, 4, 5, and 6 to the project site have been retrofitted with Emergency Vehicle Preemption (EVP) as required by CMFD.			& Rescue Department; City Public Services Department				
PS-2	In addition to compliance with standard fire protection requirements of the California Fire Code and referenced standards as adopted by the Costa Mesa Fire & Rescue Department (CMFD), the project shall provide the following three fire protection features in excess of minimum code requirements to ensure the proposed Building A and associated parking garage design meet CMFD's fire apparatus access road and hose pull requirements: ▪ Wet standpipes with one, 2.5-inch connection shall be provided at, or near, the end of each of the 300-foot hose pull reaches; ▪ An increase fire sprinkler density of 0.20 gallons per minute (GPM)/1500 without any corresponding reduction in design area due to the use of quick response sprinkler heads shall be included in the sprinkler system design; and ▪ A two-hour firefighter tunnel shall be provided to reduce the project's deficient hose pull. All other apparatus access roads, buildings, and structures on-site shall comply with the fire protection requirements of the California Fire Code and referenced standards as adopted by the CMFD.	Project Applicant	Prior to Issuance of Building Permit	City Development Services Department; Costa Mesa Fire & Rescue Department	Prior to Issuance of Building Permit			

Mitigation Number	Mitigation Measure	Implementation Responsibility	Timing	Monitoring Responsibility	Timing	VERIFICATION OF COMPLIANCE		
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5.13 TRANSPORTATION								
T-1	Prior to the issuance of the first building permit, the project applicant shall contribute its fair share contribution to the City of Costa Mesa Transportation Division for the implementation of adding a southbound right-turn lane by restriping Susan Street at the intersection Susan Street/South Coast Drive (Study Intersection No. 18). Upon project approval, the City shall update the Capital Improvement Projects list accordingly.	Project Applicant	Prior to Issuance of First Building Permit	City Public Services Department Transportation Services Division	Prior to Issuance of First Building Permit			
T-2	Prior to the issuance of the first building permit, the project applicant shall contribute its fair share contribution to the City of Fountain Valley Transportation Division for improvements to the intersection of Talbert Avenue/Mt. Washington Street (Study Intersection No. 28), including adding a traffic signal, restriping the northbound approach to a shared left through lane and a dedicated right turn lane, converting the southbound right turn lane to a dedicated channelized free right turn lane, and adding overlap phasing for a northbound right turn movement.	Project Applicant	Prior to Issuance of First Building Permit	City Development Services Department	Prior to Issuance of First Building Permit			
5.14 TRIBAL CULTURAL RESOURCES								
TCR-1	Prior to issuance of any grading permits, the qualified archaeologist (required pursuant to Mitigation Measure CUL-1) shall identify a Native American Monitor determined by the City of Costa Mesa and in consultation with the Native American Heritage Commission for the project grading activities and/or any other activities involving native soils. In the event unanticipated tribal cultural material is encountered during any stage of site disturbance/construction, the Native	Qualified Archaeologist; Native American Monitor	Prior to Issuance of Grading Permit; During Ground Disturbing Activities	City Development Services Department	Prior to Issuance of Grading Permit; Prior to and During Ground Disturbing Activities			

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	American Monitor shall be contacted and all construction work within 50 feet (15 meters) of the find shall cease until the find can be assessed. If, in consultation with the City, the discovery is determined to not be significant, work will be permitted to continue in the area. If the resources appear to be of significant tribal cultural value, they shall be professionally recovered pursuant to the requirements of Mitigation Measure CUL-1 and in consultation with the Native American Monitor identified.							

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