Appeal of PC Decision - IDI Rider Buildings 2 & 4 and PVSD Channel Project

CITY OF PERRIS

DEVELOPMENT SERVICES DEPARTMENT
PLANNING DIVISION
135 N. "D" Street, Perris, CA 92570-2200
TEL: (951) 943-5003 FAX: (951) 943-3293

PLN21-051

DATE SUBMITTED 6/28/21
CASE PLANNER ________

COMPREHENSIVE APPLICATION FOR DEVELOPMENT REVIEW AND LAND USE APPROVAL

GENERAL PLAN AMENDMENT ________
PLANNED DEVELOPMENT OVERLAY ________
CODE/ORDINANCE AMENDMENT ________
ZONE CHANGE ________
TRACT MAP ________
PARCEL MAP TPMs 37437 and 37438
CONDITIONAL USE PERMIT ________
SPECIFIC PLAN AMENDEMENT ________

VARIANCE FROM CODE ________
DEVELOPMENT PLAN REVIEW Case 19-00004 and 19-00006
ADMIN. DEV. REVIEW ________
MAJOR MODIFICATION ________
MINOR DEVELOPMENT PLAN REVIEW ________
MINOR MODIFICATION ________
SETBACK/MINOR ADJUSTMENT ________

Applicant/Contact Person. Hannah Bentley / JOSH BOURGEOIS Company: Golden State Environmental Justice Alliance
Telephone No. (951) 415-8636 Fax No. (___) ________ e-mail JBOURGEOIS029@GMAIL.COM
Mailing Address: P.O Box 79222 Corona CA 92879
STREET CITY STATE ZIP

Building Owner /Contact Person: N/A Company: ________
Telephone No. (___) ________ Fax No. (___) ________ e-mail ________
Mailing Address: ________
STREET CITY STATE ZIP

Arch-Eng/Contact Person: Unknown Company: ________
Telephone No. (___) ________ Fax No. (___) ________ e-mail ________
Mailing Address: ________
STREET CITY STATE ZIP

Complete Project Description/Reason for Request: Attach a detailed description to explain all proposed uses for this property or project, if necessary. (For Minor Adjustments or Variances explain the special conditions for circumstances applicable to the property and the privileges that would be denied and are enjoyed by other properties in the vicinity)

Golden State Environmental Justice Alliance hereby appeals the Planning Commission's approval of Development Plan Review Nos. 19-00004 and -00006 and all associated Case Numbers, and Tentative Parcel Map Nos. 37437 and 37438 to the City Council, based upon the Project's significant health and safety impacts to existing nearby residences, other impacts to air quality, impacts on agricultural resources, impacts to biological resources, impacts on energy resources, impacts as to greenhouse gas emissions, and conflicts with land use and planning policies.

General Location or address location: Approximately 99.2 acres north of Rider Street, east of Redlands Ave., south of Morgan Street, and west of the PVSD Channel.

Assessor's Parcel No(s): Rider 2: APNs 303-170-004, 005, 011, 014; Rider 4: APNs 303-160-002, 003, 007, 009
APNs for the PVSD Channel improvements are unknown.

Acreage: 99.2 acres Zoning: Light Industrial RDA Project Area: ______

Associated Case(s): 19-05-058 and 19-05-096.

S:\Planning\Applications\COMPREHENSIVE APPLICATION rev 03-12.doc

Hazardous Waste Site Certification: (Required pursuant to Section 659652.5 (f) of the California Government Code) Please see hazardous waste list at WWW.geotracker.swrcb.ca.gov/search/. At City type Perris, then enter.

The applicant/owner hereby certifies that they have consulted the list of hazardous waste sites for the City of Perris, dated unknown ***(must be filled in)***, and the project **is/is not** ***(circle one)*** located on a site included on the list of hazardous waste sites for the City of Perris.
NOTE: These questions apply to applications and not the present appeal.

Air Quality/Hazardous Materials Certification: (Required pursuant to Section 65850.2 of the California Government Code)

1. The applicant/owner herby certifies that the project **will/will not** ***(circle one)*** need to comply with the requirements for a permit for construction or modification from the South Coast Air Quality Management District, 21865 E. Copley Drive, Diamond Bar, CA 91765-4182, (909) 396-2000. UNKNOWN.
2. The applicant/owner herby certifies that the project **will/will not** ***(circle one)*** have more than a threshold quantity of a regulated substance, or will contain a source or modified source of hazardous air emissions. Please attach a list of any regulated substances and quantities anticipated, if applicable. (Note: Any quantity of hazardous waste or handling or storage of any quantity of acutely hazardous materials requires filing of a Management Plan and a permit from County Environmental health Services. A Management Plan and permit is also required for other hazardous materials if more than the threshold quantities are present, which are typically either 55 gallons of liquid, 200 cubic feet of pressurized gases, or a weight of 500 pounds.) 951/766-6524HazMat UNKNOWN.
3. Describe any use, storage, or discharge of hazardous and/or toxic materials in the known history of this property. Please list the ~~materials~~ and dates, if known. **(Attach response if appropriate)** UNKNOWN.
4. The project **is/is not** **(circle one)** located within one-quarter (1/4) mile of a school.

NOTE: Plan review, permits, and inspections are also required from the Building Division prior to any construction or occupancy of the proposed project. The applicant/owner shall comply with all requirements of the Perris Municipal Code in construction and use of the proposed project.

Processing Costs: The City operates on the basis of full cost recovery for the processing of planning projects. Deposits made at the time of application are projected to be sufficient for the processing of most applications; however, additional deposits may be required to cover the projected costs for review of projects. If at any time deposits are insufficient to cover projected costs, processing of the project will be stopped until sufficient additional funds are deposited with the City. Lack of sufficient funds on deposit will suspend any required processing time frames.

Certification: I hereby certify that I understand the deposits for processing costs, information, and requirements referenced in this application and that the information furnished above and in any attached exhibits is true and correct. The property owner further certifies that they are the legal owner of the property and consent to the application.

Hannah Bentley	06/23/21	N/A	N/A
Applicant's Signature	Date	Property Owner's signature	Date

Hannah Bentley - for Golden State Envtl Justice Alliance	
Applicant's Printed Name	Property Owner's Printed Name

Authorization to Act on Behalf of Owner

Date: ______________________

City of Perris
135 N. 'D' Street
Perris, CA 92570

To Whom It May Concern:

I am the owner of the property at (street address):

N/A - This is an appeal by an aggrieved party under the California Envtl Quality Act.

The following work will be performed at this address (description of work):

____

____

____

I authorize (print name) ______________________________ to act as my agent to obtain necessary permits for the work described above.

Furthermore, I agree to defend, indemnify, and hold the City of Perris, its elected officials, officers, directors, employees, agents, and volunteers harmless from and against any and all loss, liability, or damages, including reasonable attorneys' fees and/or court costs, arising out of the performance of this contract, except for the sole negligence of the City of Perris, its elected officials, officers, directors, employees, agents, and volunteers.

____
(property owner signature) To be Verified by Notary

____
(property owner printed name)

NOTE: If the property is a part of a corporation a list of authorized corporate officers must be provided.

REQUIRED PROPERTY OWNER(S) NOTIFICATION INFORMATION

THE FOLLOWING ITEMS WILL BE REQUIRED.

1. TWO identical packages to be inserted in separate 8 ¾ x 11-¼ manila envelopes. These envelopes shall indicate the case number and the word "labels", and shall contain the following:

   a. One typed set of gummed labels indicating all: the Assessor's Parcel Numbers, property owner(s) name(s) and the mailing addresses that are within a 300-foot radius of the exterior of their proposed project (this list shall be ascertained from the last equalized assessment roll).

   b. One label each of the owner/applicant/engineer.

   c. A photocopy of the aforementioned labels.

2. Two additional typed sets of gummed labels each of the applicant, owner, engineer, and representative with their mailing addresses. Do not include duplicate sets where applicant and owner, etc. are the same. These should be inserted in a letter-sized envelope and stapled to the ***outside*** of one of the large manila envelopes mentioned in item 1 above.

3. **Certification by a title company** that the above list is complete and accurate.

4. A 300-foot radius map on assessor's map pages, which clearly shows the Assessor's Parcel Numbers for each affected parcel (**on 8.5 x 11 size paper**).

PROPERTY OWNERS CERTIFICATION

Genevieve Vega, certify that on 6-22-21 the
(Print name) (month-day-year)
attached property owners list was prepared by Ticor Title - Genevieve Vega
(Print company or individual's name)
pursuant to application requirements furnished by the City of Perris, Department of Planning & Community Development. Said list is a complete and true compilation of owner of the subject property and all other owners within 300 feet of the property involved in the application and is based upon the latest equalized assessment rolls.

I further certify that the information filed is true and correct to the best of my knowledge. I understand that incorrect or erroneous information may be grounds for rejection or denial of the application.

NAME Ticor Title - Genevieve Vega
TITLE/REGISTRATION Customer Service
ADDRESS 330 N. 6th St. #109
PHONE 909 801 3894 FAX
SIGNATURE DATE 6-22-21

S:\Planning\Applications\COMPREHENSIVE APPLICATION rev 03-12.doc

APPEAL NARRATIVE

(To accompany appeal to Perris City Council regarding IDI Rider 2 and 4 and Perris Strom Drain Channel Improvements Project)

Appellant Golden State Environmental Justice Alliance ("GSEJA") contends as follows with respect to pages 5-6 of the City's Comprehensive Land Use Application form:

1. Change ot existing natural ground features or alteration of natural contours?

The Project will alter the natural contours of the site, which is presently undeveloped.

2. Change, modification or disruption of scenic views or vistas from adjacent private, or public lands or roadways?

The Project may alter views, although this is not a primary subject of GSEJA's appeal.

3. A change or substantial alteration to the character of the general area?

The Project will add two high-cube warehouses which would experience significant truck traffic which would be detrimental to existing residential development directly to the south, as well as nearby to the west, east, northeast, and southeast.

4. Significant change in the ambient air quality, or substantial increase of pollutant concentrations?

The Project will result in significant emissions of NO_x, which is a precursor to ozone, a pollutant for which the South Coast Air Basin is in extreme nonattainment under the federal Clean Air Act, and nonattainment under the California Clean Air Act. The Project will also result in emissions of $PM_{2.5}$, as to which the Basin is also nonattainment.

The Project would result in a significant health risk to neighboring properties because construction and operations are projected to create more than a 10 in a million increased risk of cancer based on the applicant's analysis. More than 10 in a million is the threshold for significance for cancer risks according to the relevant agency, the South Coast Air Quality Management District.

5. Significant change in the ambient noise or vibration levels?

The Project may result in a significant increase in noise but this is not a primary subject of GSEJA's appeal.

6. Is the project to be developed in an area subjected to significant noise levels?

Not to GSEJA's knowledge.

7. Significant change in the existing ground water quality or quantity or alteration to natural drainage patterns?

The Project may affect groundwater quality or quantities, but this is not a primary subject of GSEJA's appeal.

8. Create significant amount of solid waste or trash?

The Project may result in significant quantities of waste or trash but this is not a primary subject of GSEJA's appeal.

9. Is the project to be developed on filled land or slopes in excess of 10 percent?
The Rider 2 and 4 Buildings would be developed on fill, but aside from air quality impacts due to the scrapers moving that fill, this is not a primary subject of GSEJA's appeal.

10. Will the project require the use or disposal of potentially hazardous materials such as toxic substances, flammable, explosives, etc.?
Not to GSEJA's knowledge.

11. Substantial change in demand for municipal services or infrastructure (police, fire, water, sewage, etc.)?
Not to GSEJA's knowledge; this is not a primary subject of GSEJA's appeal.

12. Does the project have a relationship with a larger project or series of projects?
This Project involves the construction of two high-cube warehouses which is part of a larger project of at least four or five high-cube warehouses which the applicant is planning on marketing as the IDI Logistics Center. The IDI Logistics Center should have been evaluated as one project and GSEJA contends the Project was piecemealed in violation of the California Environmental Quality Act ("CEQA") as a result.

13. Has a prior environmental report been prepared of which this project is a part?
Rider 1 and 3 were the subject of earlier EIRs, but all the warehouses should have been evaluated together to comply with CEQA.

14. If you answered yes to question 13, could this project cause significant effects that were not covered or examined within the prior environmental report?
Yes, the present Project will have significant impacts or potentially significant impacts to agricultural resources, air quality, energy, greenhouse gases, and land use and planning.

15. Will the project conflict with any City adopted plans or goals?
Yes. The Project conflicts with SCAG's most recent RTP/SCSs, as well as the County of Riverside's Ordinance No. 663 as amended concerning the Stephens' kangaroo rat ("SKR"), because no protocol surveys were conducted, and the Western Riverside County Multiple Species Habitat Conservation Plan ("MSHCP"), because that Plan incorporates the standards of the 2012 California Department of Fish & Wildlife Staff Report on Burrowing Owl Mitigation, which require larger buffers around active burrowing owl nests during construction than the applicant has provided for.

16. Affect a rare or endangered species of animal or plant or the habitat of the species?
Yes. See response to #15 above.

17. Interfere substantially with the movement of any resident or migratory wildlife species?

See response to #15 above with respect to the SKR and the Western burrowing owl.

18. Disrupt or adversely affect a prehistoric or historic archaeological site . . . ?

Not to GSEJA's knowledge, but this is not a primary focus of GSEJA's appeal.

19. Cause substantial growth or population increase?

Possibly; this was addressed in GSEJA's comment letter of November 16, 2020, a copy of which is in the possession of City staff and which GSEJA specifically incorporates into this appeal.

20. Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system?

Possibly; this point is addressed in GSEJA's comment letter of November 16, 2020, a copy of which is in the possession of City staff and which GSEJA specifically incorporates into this appeal.

21. Encourage activities which result in the use of large amounts of fuel, water or energy?

Yes; this point is addressed in GSEJA's comment letters of November 16, 2020 and June 16, 2021, copies of which are in the possession of City staff and both of which GSEJA specifically incorporates into this appeal.

22. Is the project located in an area which could expose people or structures to major seismic or flooding hazards?

Possibly, although this is not a primary focus of GSEJA's appeal.

23. Will the project cause a utility extension or sizing, in excess of that required to serve the project?

Possibly, although this is not a primary focus of GSEJA's appeal.

24. Could the project cause significant disruption or interference to an existing community?

Yes. Please see response to # 4 above.

25. Could the project cause the conversion of prime agricultural land to non-agricultural use or resources or impair the productivity of agricultural lands?

The Project would cause the conversion of agricultural lands of Statewide Importance. Although the Planning Commission relied on the DEIR which concluded impacts would be less than significant under the Land Evaluation and Site Assessment ("LESA") model, GSEJA believes that the Land Evaluation component of the model was under-evaluated because the acreage devoted to the Perris Valley Storm Drain Channel may have been included.

26. Is the project located within a 100-year or 500-year floodplain?

The Project is within a 100-year floodplain according to the Draft EIR for the Project.

Proposed Findings regarding Development Plan Review (DPR) 19-00004 and 19-00006
On Appeal to City Council of City of Perris

A. The location, size, design, density and intensity of the proposed development and improvements are inconsistent with the development policies and standards the City is required to apply.

The City Council hereby finds the Project is inconsistent with the requirements of the Western Riverside County Multiple Species Habitat Conservation Plan ("MSHCP") based upon the Project's failure to provide adequate buffers to the Western burrowing owl in compliance with the California Department of Fish & Game's (now California Department of Fish & Wildlife's) Staff Report on Burrowing Owl Mitigation, which is applicable under the MSHCP Guidelines. The Project is further inconsistent with Riverside County Ordinance No. 663 as amended because no protocol surveys were conducted for the Stephens' kangaroo rat ("SKR"), so the conclusion that the payment of an SKR mitigation fee is sufficient is incorrect.

B. The proposed development and the conditions under which it would be operated or maintained is incompatible with abutting properties and will be detrimental to the public health, safety or welfare.

The proposed warehouse buildings and the conditions under which it would be operated or maintained are incompatible with preexisting.residential properties immediately to the south, as well as to the west, east, northeast, and southeast. The applicant's screening Health Risk Assessment for construction, when combined with the applicant's Health Risk Assessment for operations of the Project, reveals that residents will be subject to a combined health risk in excess of 10 in a million, which is the South Coast Air Quality Management District's standard for significance.

C. The safeguards necessary to protect the public health, safety and general welfare have not been required for the proposed Project.

The proposed project does not adequately provide the safeguards necessary to protect the public health, safety and general welfare through the conditions of approval, which failed to sufficiently reduce concentrations of diesel particulate matter ("DPM") expected to be emitted by the Project.

BLUM | COLLINS LLP

Aon Center
707 Wilshire Boulevard
Suite 4880
Los Angeles, California
90017

213.572-0405 phone
213.572-0401 fax

November 16, 2020

Mary Blais, Contract Planner
City of Perris Planning Division *Via email*
135 North "D" Street
Perris, CA 92570
mblais@cityofperris.org

Re: Comments on IDI Rider 2 &4 High Cube Warehouses and PVSD Channel Improvement Project EIR (SCH No. 2019100297)

Dear Ms. Blais and the City of Perris:

Thank you for the opportunity to comment on the Environmental Impact Report (EIR) for the proposed IDI Rider Warehouses 2 and 4 Project. Please accept and consider these comments on behalf of Golden State Environmental Justice Alliance ("GSEJA"). Also, GSEJA formally requests to be added to the public interest list regarding any subsequent environmental documents, public notices, public hearings, and notices of determination for this project, by email to bentley@blumcollins.com and colllins@blumcollins.com.

1.0 Summary

The project proposes the construction and operation of two warehouse buildings totaling 1,352,736 square feet on a 65 net acre site, improvements to a portion of the PVSD Channel, and replacement of the Rider Street bridge over the PVSD Channel. The DEIR says in total that the Project spans 99.2 acres, with 4.5 acres being offsite. The proposed Rider 2 building is 804,759 sf and the proposed Rider 4 building is 547,977 sf. The EIR states the two buildings would include 10,000 sf office space total. Building 2 would have 132 dock doors on the north and south sides and Building 4 would have 121 dock doors on the east and west sides. The Project would involve two Tentative Parcel Maps for the merging of several parcels to form the Rider 2 and 4 sites.

Construction is anticipated to last either 14 months with one-stage bridge construction or 19 months with two-stage bridge construction. Our comments will focus on the two-stage alternative as it is the more impactful.

1.1 Project Piecemealing

The EIR does not accurately or adequately describe the project, meaning "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment" (CEQA § 15378). The project proposed by Rider 2 and Rider 4 is a piecemealed portion of a larger overall project to be developed within the larger Rider Logistics Center in the City of Perris, containing a minimum of 4 warehouse buildings. The Rider 1 building was approved in 2007 (DPR 06-0365) and is 492,282 square feet (sf). The Rider 3 building was approved in 2009 (DPR 06-0432) and is 643,263 sf. It should also be noted that in 2008 development of a smaller warehouse was approved on the Rider 2 site (378,521 sf compared to the currently proposed 804,759 sf warehouse) but not constructed. Construction of the Rider 1 and 3 warehouse buildings is complete.

CEQA § 15165 - Multiple and Phased Projects requires that "Where individual projects are, or a phased project is, to be undertaken and where the total undertaking comprises a project with significant environmental effect, the Lead Agency shall prepare a single program EIR for the ultimate project as described in Section 15168." The EIR misleads the public and decision makers by circumventing adequate and accurate environmental analysis for the whole of the action - construction and operation of all Rider Logistics Center Buildings as a whole. A program EIR should have been prepared accurately representing the whole of the action without piecemealing the project into separate, smaller development projects to present unduly low environmental impacts. It is clear that the project historically included multiple buildings (minimum of 4) as the 2007 approval was named Rider 1 and the 2009 approval was named Rider 3, holding space for today's Rider 2 building. The EIR must be revised to comply with CEQA § 15165 by preparing a Program EIR pursuant to CEQA § 15168. This is vital as the proposed Rider 2 and 4 buildings will result in significantly unavoidable cumulatively considerable impacts to Air Quality and Greenhouse Gas emissions.

1.2 Project Implementation Prior to CEQA Review

Aesthetics View 5 depicts construction/grading work at the Building 4 project site from the vantage point of Redlands Avenue between Morgan Street and Rider Street. The EIR states in the Aesthetics analysis that "Redlands Avenue is under construction." Construction of the street improvements is implementation of the project prior to CEQA review. The Traffic Impact Analysis requires the following roadway improvement to be completed by the project:

> Construct Redlands Avenue at its ultimate half-section width as a Secondary Arterial (94-foot right-of-way) between Morgan Street and Rider Street consistent with the PVCC SP and the City of Perris General Plan Circulation Element. The Project Applicant would improve Redlands Avenue as required by the final Conditions of Approval for the Project and applicable City of Perris standards.

It is flatly contrary to CEQA to permit work prior to CEQA review. *See, e.g.,* Pub. Res. Code § 21061; CEQA Guidelines, § 15002(a)(1), (3) (purposes of CEQA); *Save Tara v. City of West Hollywood* (2008) 45 Cal. 4th 116, 130; *No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal. 3d 68, 79 & n.8 (environmental review, including any required Environmental Impact Report ("EIR"), must be completed and considered prior to project approval). All work must cease, and a revised EIR must be prepared to accurately analyze the potentially significant environmental impacts, including those related to project implementation prior to CEQA review and a change in environmental setting.

4.2 Agricultural Resources

Under Threshold a., the DEIR asks, "Would the Project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance . . . to non-agricultural use?" The answer is a resounding yes, and no steps have been taken to address this impact, despite the greenhouse gas ("GHG") implications of converting agricultural or fallow land to two massive distribution centers. The fact that the 1991 General Plan EIR rezoned the sites does not immunize this issue from challenge in response to the present EIR, for it is in the present EIR that the land is being "convert[ed]," as noted in the Threshold.

4.3 Air Quality

Please see the accompanying letter and attachments from SWAPE for technical commentary and analysis.

The DEIR states that cold storage use is not planned for the Rider 2 or 4 Buildings. We know of no limitations in the Buildings' designs that would prohibit their use for cold storage, and even if the Buildings ***did*** prohibit cold storage (which the City should require, through a condition of approval barring cold storage uses on the site), that would not prevent trucks with TRUs from accessing the site anyway, and in fact the City has proposed a mitigation measure ("MM") which would regulate TRUs onsite. The City did not analyze the impacts of any TRU use in its HRA, and they should be flatly prohibited through a condition of approval which requires a CC&R running with the land which bars TRUs onsite, and which demands that all tenants sign an agreement to that effect in their leases.

The EIR asserts that SCAQMD is not responsible for regulating mobile sources. Until the D.C. Circuit decides upon California's waiver under the federal Clean Air Act, CARB is, and the City should have done way more to address its comments, including preparing a construction HRA. In fact, the statement that SCAQMD is the agency principally responsible for comprehensive air pollution control ignores CARB's role.

Under *Air Quality Management Plan*, the DEIR asserts that CARB released a SIP Update the AQMP, the 2019 South Coast 8-Hour Ozone SIP Update, which is intended to achieve "the remaining NO_x emissions reductions needed to achieve the ozone standard in 2023." This is not exactly accurate and seriously understates the severity of ozone problems in the Basin. Attachment A to these comments is SCAQMD's Table, "National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) Attainment Status for the South Coast Air Basin," which, according to SCAQMD's website, is current at least as of September 2018, *see* www.aqmd.gov/home/air-quality/clean-air-plans. As the Table reflects, the South Coast Air Basin is not projected to be in compliance with the NAAQS until 2038 and is considered to be in "Extreme Nonattainment" with respect to the 2015 8-Hour Standard of 0.070 ppm. The Basin is also in Serious Nonattainment with respect to the 2012 Annual NAAQS of 12.0 ug/m^3, with a projected attainment date of December, 2025. The DEIR fails to convey this information at 4.3-6, and the reference to the SIP Update is only with respect to the 1997 8-Hour NAAQS of 0.075 ppm. We are presently in "Extreme" Nonattainment with respect to three National ozone Standards. It's also important to note that the CARB SIP Update depended on a number of federal measures to achieve the majority of the reductions in NO_x that are needed, and that these measures are not likely to be implemented, so health conditions for local residents are likely to be worse than advertised in the DEIR. Finally, since you brought it up, CARB wrote in the SIP Update that one of the State's strategies would be to conserve natural and working lands by "limiting opportunities for expansive, vehicle dependent forms of development," which is precisely what this Project represents, and another would be to provide additional funding to zero and near-zero emission vehicles which the Project does not plan to support.

The DEIR states at 4.3-17 that

> The construction schedule utilized in the analysis, is shown in Table 3-2 and Tabl3 3-3 of this EIR, and represent [sic] a "worst-case" analysis scenario should construction occur any time after the respective dates since emissions factors for construction decrease as time passes and the analysis year increases.

It does not appear that CARB regulations are going to change appreciably in the near term, so there is no reason to believe construction emissions would be significantly reduced if construction occurred later.[1]

Stepping back a moment, the analysis under Threshold a, whether the Project would conflict with or obstruct the applicable AQMP, is incorrect. According to SCAQMD's CEQA Air Quality Handbook (1993), at 12-2 to 12-3, there are ***two*** criteria for whether a project is consistent with an AQMP, and the first of those is whether the project will increase the frequency or severity of existing air quality violations, cause or contribute to new violations, or delay the timely attainment of an Air Quality Standard. That is the case for this Project, as we learn under Threshold b., and therefore, the Project is ***not*** consistent with the AQMP. If your consultant has not included the Air Quality Handbook in the Administrative Record for this Project please advise us immediately and we will send you a copy.

Under Threshold b., the DEIR does acknowledge a significant impact both as to construction and operations with respect to NO_x. With respect to construction, it asserts that

> The NO_x exceedance is primarily due to the overlap in construction activities with the majority of emissions occurring during the Rider 2 and 4 Warehouse Construction – Building Construction phase (due to vendor trips accessing the Project area),

and that the City of Perris can't control tailpipe emissions, so, Oh Well!, there is a significant and unavoidable impact. We took a look at the CalEEMod analysis, and there are plenty of emissions from off-road construction equipment, both with respect to bridge construction in 2021, and they likely also exceed the threshold during the combined phase of Grading/Excavation/Removing Existing Bridge under the two-phase bridge scenario. Construction of the buildings would lead to about 21.21 pounds of NO_x per day in 2021. Mitigation of these emissions would be possible through the use of Tier 4 equipment rather than Tier 3 equipment. The difference would likely be substantial, since Tier 4 equipment reduces NO_x emissions by 90%.

The argument is also contrary to CEQA's mandate that a lead agency must adopt all feasible mitigation with respect to any significant impact. In other words, the City cannot simply wash its hands of a significant impact just because it can't reduce impacts to a less-than-significant level. We're not required to write a brief here, but *see City of Marina v. Bd. of Trustees of Cal.*

---

[1] There is a footnote to the quoted sentence in the DEIR which is blank.

State Univ. ("*City of Marina*") (2006) 39 Cal. 4th 341, 349, *citing* Pub. Res. Code §§ 21002.1(a), (b), 21100(b)(3), and Guidelines § 15126.4(a)(1) ("CEQA requires '[e]ach public agency [to] mitigate or avoid the significant effects on the environment of projects it carries out or approves whenever it is feasible to do so' and to discuss feasible methods of mitigation in the EIR").

The DEIR repeats this fallacy (that the City is required to do nothing because most emissions come from mobile sources which it doesn't regulate) in its discussion of operational impacts, which are also significant. The City could require the installation of Electric Vehicle Charging Stations or Electric Vehicle Supply Equipment ("EVSE") for cars. It can require the extension of electrical conduit to the truck charging bays. And it can require the installation of solar power. All three of these measures would reduce impacts to air quality as well as GHGs. Again, the City is required to impose all feasible mitigation even if it can't reduce impacts to less-than-significant levels.

At 4.3-30, the text completely misstates the amount of NO_x project operations would emit. It's 159.55 pounds a day, ***not*** 59.55.

The City ***has*** included an MM to indicate that electrical supply lines and panels shall be sized to support heavy truck charging when electric trucks become available (they are available ***now***, *see* Attachment C), but it states that "Electrical system upgrades that exceed reasonable costs shall not be required," which is entirely standardless and makes the measure totally toothless.

Under Threshold c., the DEIR attempts to address why a Construction Health Risk Assessment ("HRA") was not prepared. CARB asked for one. The City's consultant says, "the determination of whether a construction [HRA] is warranted is dependent on whether or not early life exposure adjustments apply to DPM resulting from construction activity." This is baloney, because:

1. The consultant used early life exposure adjustment factors in its Operational HRA, and DPM is DPM,
2. SCAQMD has repeatedly recommended that lead agencies use early life adjustment factors in its comments to lead agencies under CEQA. *See* SWAPE letter, n. 25, *and see* SCAQMD's comments on the West Valley Logistics project in Fontana (Attachment D), and SCAQMD's comments on the Altitude Business Centre in Chino (Attachment E), and
3. As quoted in the EIR, OEHHA clearly recommends analyzing construction in cases where it occurs for more than two months, which is a lot shorter than nineteen months.

We also question the Operational HRA's accuracy, because it placed the most exposed resident 110 feet away as opposed to at that resident's property line, which is also inconsistent with how the LST analysis was performed.

The EIR does not include for analysis relevant environmental justice issues in reviewing potential impacts, including cumulative impacts from the proposed project. This is especially significant as the surrounding community is highly burdened by pollution. According to CalEnviroScreen 3.0, CalEPA's screening tool that ranks each census tract in the state for pollution and socioeconomic vulnerability, the proposed project's census tract (6065042620) ranks worse than 95% of the rest of the state overall. The surrounding community (including residents to the northwest and east, and May Ranch Elementary School to the east) bears the impact of multiple sources of pollution and is more polluted than average on every pollution indicator measured by CalEnviroScreen. For example, the project census tract has a higher burden of ozone than 98% of the state, a higher burden of PM 2.5 than 84% of the state, and a higher concentration of drinking water contaminants than 87% of the state.

Further, the project's census tract is a diverse community including 65% Hispanic and 12% African-American residents, which are especially vulnerable to the impacts of pollution. The community has a high rate of low educational attainment, meaning 76% of the census tract over age 25 has not attained a high school diploma, which is an indication that they may lack health insurance or access to medical care. The community ranks in the 92nd percentile for incidence of cardiovascular disease and 57th percentile for asthma, which are exacerbated by Air Quality and Greenhouse Gas impacts. The environmental burden is heightened further as the census tract is comprised of 19% children under the age of 10 compared to an average 13% children under the age of 10 per census tract in California.

4.4 Biological Resources

According to the Biological Technical Report for the PVSD Channel, protocol level surveys were not conducted for the least Bell's vireo, the southwestern willow flycatcher, the yellow-billed cuckoo, or three species of listed fairy shrimp which are covered by section 6.1.2 of the MSHCP, Volume I, even though there was riparian and riverine habitat as the MSHCP defines it.

With respect to the Stephens' kangaroo rat or SKR, the DEIR claims that no surveys were required because core reserves were deemed complete in December of 2003. However, it is clear that payment of a fee is not enough under Riverside County Ordinance No. 663 as amended through August 6, 1996 (Attachment F). Section 7 of that Ordinance says that a mitigation fee is only appropriate if it is determined through the environmental review process that onsite mitigation is not warranted.

Under the first Threshold, substantial adverse effects on candidate, sensitive or special status species, either through habitat modifications or directly, the DEIR fails to acknowledge that the burrowing owl ("BUOW") could well be impacted given that one was identified 88 feet away (and it was not looked for in the last year). The Project's BUOW mitigation is less than adequate as well. MM 4-2 provides for noise attenuation to assure noise from construction won't exceed 75 dBA L_{eq} within 300 feet of a BUOW territory, and PVCCSP EIR MM Bio 2 previously provided that BUOW nest avoidance should be achieved at a distance of 250 feet from active nests during the breeding season, but our understanding under the CDFW Staff Report, the required distance during breeding season is 500 meters. *See* Attachment G. Additionally, preconstruction surveys should occur no more than 14 days before development activities, ***not*** 30 days in advance as provided for in the MM. We note that the MSHCP Guidelines regarding the BUOW explicitly make the CDFW 2012 Staff Report applicable. *See* Attachment H.

4.6 Energy

The Energy section of the DEIR starts with a discussion of national and statewide energy consumption, which is far from helpful.

Threshold a. is set out to be whether there is a potentially significant impact due to wasteful, inefficient, or unnecessary consumption of energy resources during construction or operation. We disagree with the statement of the threshold based on the case law and the wording of Appendix F, which calls for the "wise and efficient" use of energy, which the DEIR does not demonstrate.

At least two cases establish that a lead agency does not demonstrate compliance with Appendix F by merely showing compliance with Title 24: *Ukiah Citizens for Safety First v. City of Ukiah* (2016) 248 Cal. App. 4th 256, 265, and *California Clean Energy Comm. v. City of Woodland* (2014) 223 Cal. App. 4th 173, 211. This case is no different, as the DEIR does not demonstrate any way in which the Project goes beyond Title 24, and the MM that states that developments "shall be encouraged to implement" greater energy savings is of course entirely meaningless.

With respect to construction fuel use, the DEIR states more than once that it should be "noted" that this would represent a "single-event" demand. This is irrelevant as gasoline fuel is a nonrenewable resource.

With respect to Threshold b., the DEIR does not discuss any plans for installation of solar or renewable energy or for the conservation of energy, although such plans abound, such as the California Energy Plan and the Integrated Energy Policy Report. All of these would favor the installation of renewable energy onsite as well as EV charging capacity for trucks and cars.

Because when properly analyzed, the Project would have significant impacts, the City needs to impose mitigation including the installation of solar panels the City said it was going to have on 20% of its new commercial roofing in its CAP.

4.8 Greenhouse Gases (GHGs)

The DEIR more or less starts this section by stating that California emitted an average of 424.1 MMTCO$_2$e between 2000 and 2017. This kind of misses the point that California is necessarily on a downward trajectory in terms of GHG emissions and that the City of Perris should be following suit. The State achieved its AB32 goal of reducing emissions to 1990 levels in 2016 and has not looked back, as discussed in CARB's Report, "California Greenhouse Gas Emissions for 2000 to 2018: Trends of Emissions and Other Indicators," *available at* https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2018/ghg_inventory_trends_00-18.pdf.

The DEIR acknowledges that EPA and NHTSA published a proposal to freeze the model year 2020 standards through model year 2020 and to revoke California's waiver under the federal Clean Air Act to establish more stringent GHG standards, but the DEIR misses the point that the City will have that much harder of a time to demonstrate emissions reductions because vehicles are likely to emit more than they would have if this had not happened.

Under State regulations the DEIR then discusses Title 24 Part 6 and Part 11, CALGreen. The extensive discussion here is probably not warranted, as all of the requirements listed are just that – preexisting requirements.

In a similar vein, the discussion of SB375 is probably unnecessary as the Project cannot do anything to demonstrate consistency with the SCAG RTP/SCS (either the 2016 or 2020 versions), because it is not a residential or mixed-use Project.

At 4.8-11 and 4.812 the City acknowledges that the 2017 CARB Scoping Plan Update calls for "contributions from all sectors of the economy, including the land base," including "enhanced focus on zero- and near-zero emission (ZE/NZE) vehicle technologies," and "continued investment in renewables, including solar roofs, wind, and other distributed generation." The

City also cites "integrated land conservation and development strategies," and "coordinated efforts to reduce emission so short-lived climate pollutants" such as "black carbon." DPM is mainly made up of black carbon. *See* CARB's discussion of this point at https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health, under "Environmental Effects of Diesel Exhaust."[2] The City isn't assisting with any of these strategies with this Project so it is interesting that the City would acknowledge that they are the major features local governments can work on to reduce GHG emissions.

Still in the introductory section, the DEIR refers to the City of Perris CAP and states that the CAP has a 2035 reduction target. Whether it has this target or not, there was and is no substantial evidence that the City has planned for or demonstrated reductions into 2035, and the CAP acknowledged that it needed updating in 2017, which never happened. The Perris Climate Action Plan is available at https://www.cityofperris.org/Home/ShowDocument?id=12935. We presume the City will include it in the Administrative Record since the DEIR relies upon it, as well as all the other documents we provided specific hyperlinks to, under established case law.

Threshold a. acknowledges a significant impact with respect to the emission of GHGs directly or indirectly, because the Project's emissions will exceed the SCAQMD bright-line threshold of 10,000 $MTCO_2e$ per year, even after the implementation of the MM's from the PVCCSP EIR and MM's 3-1 through 3-14. These mitigation measures do not include the SCAQMD- and CARB-recommended solar panels and EV charging stations. Emissions could be significantly reduced, and these MM's are not infeasible at all.

Threshold b. analyzes compliance with the City of Perris Climate Action Plan and the 2017 Scoping Plan Update. We commend SWAPE's comments to you on both points. Addressing the Perris CAP first, it is out of date, which it acknowledges itself at the end at page 4-7: "there will be a need to start planning for the pst-2020 period," etc. And contrary to the statement at 4.8-23, the Project ***would*** conflict with the applicable GHG reduction measures in the CAP, because the CAP calls, in measure R2-E4, "Commercial Renewable Energy Requirements," for "20% of electricity from new commercial development" to be provided by solar or renewable energy, and that "an average of 5 kW of solar photovoltaic cells would be installed per 10,000 square feet of building space." The City has over 100 times that square footage in the two buildings proposed with not a kW of solar going on top of them.

While it's a moot point because the CAP is out of date and should not have been used, we also note that the CAP is entirely inconsistent internally as to the City's overall GHG emissions. At page 3-47, it states that they were supposedly 131,138 $MTCO_2e$ in 2010, and that with reductions, emissions in 2020 would be 111,467 $MTCO_2e$. This is inconsistent with the statements elsewhere that the City's emissions were 378,099 $MTCO_2e$ in 2010, and that 2020 emissions were expected to be 513,764 $MTCO_2e$ in 2020 and 690,648 $MTCO_2e$ in 2035. The notion that the City is going to reduce emissions to 67,110 $MTCO_2e$ with the minimal measures presented is simply implausible.

With respect to the CARB Scoping Plan 2017 Update, Table 4.8-6's Scoping Plan Consistency Summary lacks credibility as well. Under "Implement California Sustainable Freight Action Plan," the Table states that CARB has identified as a strategy to "Deploy over 100,000 freight vehicles and equipment capable of zero emission operation and maximize both zero and near-

---

2 We note that the City has understated the GHG impacts of the Project because CalEEMod does not yet account for the effects of black carbon.

zero emission freight vehicles and equipment powered by renewable energy in 2030." The DEIR claims this strategy is supposedly "Not Applicable." Why not? The Project could accommodate these zero-emission and renewable-powered freight vehicles, but the City chooses not to bring about that outcome – despite SCAQMD and CARB suggestions on both points. Under "Implement the Short-Lived Climate Pollution Strategy by 2030," the Table states that CARB has included "50% reduction in black carbon emissions below 2013 levels," and the Table says somehow that the Project is "Consistent" with this goal. We're not sure how. The minimum of 124 trucks for Rider 4 and 186 trucks for Rider 2 anticipated in the DEIR (see DEIR Table 4.3-13) would all be emitting black carbon. Of course the Project is going to interfere with CARB's goals. Finally, with respect to the Update's goals relating to Natural and Working Lands, the Table refers to CARB's goal to "Protect land from conversion through conservation easements and other incentives," but the City is precisely ***not*** imposing a conservation easement on this natural open space, it is allowing them to be filled with two large distribution centers. Clearly it does obstruct "agency efforts to protect land from conversion."

4.9 Hazards and Hazardous Materials

The Rider 2 site is within Compatibility Zone C1 and D of the 2014 MARB/IP Airport Land Use Compatibility Plan (ALUCP). The EIR does not include the proposed 1,000 sf gym depicted in Figure 3-4 Conceptual Site Plan - Rider 2 Building for analysis with MARB's land use intensity maximums. MARB's Appendix C - Methods for Determining Concentrations of People notes that exercise rooms generate 1 person per 50 sf[3], which must be included for analysis in a revised EIR.

4.11 Land Use and Planning

Table 4.11-1 SCAG Policy Consistency Analysis is erroneous and misleading to the public and decision makers. For example, the EIR concludes that the project is consistent with SCAG's 2016-2040 RTP/SCS Goal 6 to protect the environment and health for our residents by improving air quality and encouraging active transportation (non-motorized transportation, such as bicycling and walking) because the project will construct required street and right-of-way improvements. The consistency determination is erroneous as the EIR finds the project will result in significant and unavoidable cumulatively considerable Air Quality and Greenhouse Gas emissions impacts.

Further, the EIR's analysis with SCAG's 2020-2045 Connect SoCal is also erroneous and misleading to the public and decision makers. The EIR finds consistency with Goal 5 to reduce greenhouse gas emissions and improve air quality, Goal 6 to support healthy and equitable communities, and Goal 7 to adapt to a changing climate even though the project will even though the project will result in significant and unavoidable cumulatively considerable Air Quality and Greenhouse Gas emissions impacts in an inequitable manner within a disadvantaged community as noted above. The EIR must be revised to include a finding of significance due to these inconsistencies with both the 2016-2040 and 2020-2045 RTP/SCS documents.

The EIR's consistency analysis with the Perris General Plan is also erroneous and misleading to the public and decision makers. The EIR concludes the project is consistent with Healthy

---

[3] MARB Appendix C - Methods for Determining Concentrations of People http://www.rcaluc.org/Portals/13/PDFGeneral/plan/newplan/23-%20Appendix%20C.%20Determining%20Concentrations%20of%20People.pdf

Communities Element Goal 6 to support efforts of local businesses and regional agencies to improve the health of our region's environment and Policy HC 6.1. support regional efforts to improve air quality through energy efficient technology, use of alternative fuels, and land use and transportation planning even though the project will result in significant and unavoidable cumulatively considerable Air Quality and Greenhouse Gas emissions impacts. The EIR also states the project is consistent with Policy HC 6.3 to promote measures that will be effective in reducing emissions during construction activities, even though the EIR finds that "long-term nitrogen oxides (NOx) emissions from *construction* of the Project (including the PVSD Channel improvements and Rider Street bridge), and mobile sources during operation, would exceed established South Coast Air Quality Management District (SCAQMD) thresholds of significance." The EIR must be revised to include a finding of significance due to these inconsistencies with the Perris General Plan.

4.13 Transportation

The project's VMT impacts are misrepresented by the RivTAM model. The Transportation analysis relies upon a VMT screening analysis which concludes that the proposed Project site is located in a low VMT-generating Traffic Analysis Zone (TAZ) which results in less than significant Transportation impacts. The project is located in TAZ ID 3810, which is bound by Ramona Expwy to the north, Perris Boulevard to the west, Rider Street to the south, and the Perris Valley Storm Drain Channel to the east. The TAZ is mostly comprised of vacant land with a few underdeveloped properties and a mobile home park. The proposed project is unique in that the TAZ in which the Project site is located only contains 1 other warehouse building.

Further, Fehr and Peer's WRCOG SB 743 Implementation Pathway Document Package[4] states that the Governor's Office of Planning and Research (OPR) "recommends that a per capita or per employee VMT that is fifteen percent below that of existing development" is a reasonable threshold to determine that a project would have a less than significant VMT impact. The document also notes that the OPR recommended VMT thresholds "are almost exclusively based on GHG and air pollution reduction goals," and the proposed project results in significant and unavoidable cumulatively considerable Air Quality and Greenhouse Gas emissions impacts, with mobile source emissions (traffic) as a major contributor. Table 4.2 Trip Summary of the Air Quality Appendix CalEEMod output sheets indicate that the project will generate approximately 1,923 average daily trips and 19,241,072 annual VMT (19,241,072 / 365 days = 52,716 daily total VMT) which is exponentially higher than the project TAZ VMT per capita of 16.42 and VMT per employee of 10.66. It is also exponentially higher than the City's VMT per capita of 15.05 and VMT per employee of 11.62.

The goal and legislative intent of SB 743 is to reduce greenhouse gas emissions. The project generates significant and unavoidable cumulatively considerable Air Quality and Greenhouse Gas emissions impacts due to emissions from mobile sources (truck/trailer and passenger car traffic). The EIR is nonsensical and unreliable as an informational document to conclude that the project generates low VMT while contributing cumulatively to Greenhouse Gas emissions, which is incompatible with SB 743.

---

[4] WRCOG SB 743 Implementation Pathway Document Package https://www.fehrandpeers.com/wp-content/uploads/2019/12/WRCOG-SB743-Document-Package.pdf

6.1.2 Effects Determined Not to be Significant - Population and Housing

The EIR utilizes uncertain language to conclude there will be no significant cumulative impacts because it is "anticipated" that short-term construction jobs and operational warehousing jobs would "for the most part" be filled by workers who would already reside in the local area. The EIR does not demonstrate that the City's existing labor force is qualified or interested in these jobs. The EIR does not even attempt to quantify the number of construction jobs generated by the project and only discusses that they would "for the most part" already reside in the local area, and the "local area" is undefined. Additionally, the EIR concludes the project's generation of 1,313 jobs would represent approximately 2.3 percent of the total employment generation anticipated in the Specific Plan area and approximately 4.1 percent of the City's projected employment base by 2040 in SCAG's 2016 RTP/SCS. However, the EIR does not provide any meaningful evidence to support this claim, such as the current number of residents/jobs or the anticipated increase in residents/jobs generated by approved projects or cumulative projects in the pipeline. Further, SCAG's 2020-2045 RTP/SCS projections for employment should also be utilized for analysis as it was adopted by SCAG's Regional Council on September 3, 2020 and the EIR was made available for review on September 30, 2020. The EIR must be revised to include meaningful evidence to support the conclusion that the project will not induce unplanned indirect or direct population growth.

Conclusion

For the foregoing reasons, GSEJA believes the EIR is flawed and an amended EIR must be prepared for the proposed project and recirculated for public review. Please advise us by email of any developments on this Project. Thank you.

Sincerely,

Hannah Bentley

Hannah Bentley
BLUM | COLLINS LLP

National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) Attainment Status for South Coast Air Basin

CRITERIA POLLUTANT	STANDARD	AVERAGING TIME	DESIGNATION [a)]	ATTAINMENT DATE [b)]
1-Hour Ozone	NAAQS	1979 1-Hour (0.12 ppm)	Nonattainment (Extreme)	2/6/2023 Originally 11/15/2010 (not attained)[c)]
	CAAQS	1-Hour (0.09 ppm)	Nonattainment	N/A
8-Hour Ozone[d)]	NAAQS	1997 8-Hour (0.08 ppm)	Nonattainment (Extreme)	6/15/2024
	NAAQS	2008 8-Hour (0.075 ppm)	Nonattainment (Extreme)	7/20/2032
	NAAQS	2015 8-Hour (0.070 ppm)	Nonattainment (Extreme)	8/3/2038
	CAAQS	8-Hour (0.070 ppm)	Nonattainment	Beyond 2032
CO	NAAQS	1-Hour (35 ppm) 8-Hour (9 ppm)	Attainment (Maintenance)	6/11/2007 (attained)
	CAAQS	1-Hour (20 ppm) 8-Hour (9 ppm)	Attainment	6/11/2007 (attained)
NO_2[e)]	NAAQS	1-Hour (0.10 ppm)	Unclassifiable/Attainment	N/A (attained)
	NAAQS	Annual (0.053 ppm)	Attainment (Maintenance)	9/22/1998 (attained)
	CAAQS	1-Hour (0.18 ppm) Annual (0.030 ppm)	Attainment	---
SO_2[f)]	NAAQS	1-Hour (75 ppb)	Designations Pending (expect Uncl./Attainment)	N/A (attained)
	NAAQS	24-Hour (0.14 ppm) Annual (0.03 ppm)	Unclassifiable/Attainment	3/19/1979 (attained)
PM10	NAAQS	1987 24-hour (150 µg/m^3)	Attainment (Maintenance)[g)]	7/26/2013 (attained)
	CAAQS	24-hour (50 µg/m^3) Annual (20 µg/m^3)	Nonattainment	N/A
PM2.5 [h)]	NAAQS	2006 24-Hour (35 µg/m^3)	Nonattainment (Serious)	12/31/2019
	NAAQS	1997 Annual (15.0 µg/m^3)	Attainment	8/24/2016
	NAAQS	2012 Annual (12.0 µg/m^3)	Nonattainment (Serious)	12/31/2025
	CAAQS	Annual (12.0 µg/m^3)	Nonattainment	N/A

(over)

National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) Attainment Status for South Coast Air Basin

CRITERIA POLLUTANT	STANDARD	AVERAGING TIME	DESIGNATION [a)]	ATTAINMENT DATE [b)]
Lead	NAAQS	3-Months Rolling (0.15 μg/m^3)	Nonattainment (Partial)[i)]	12/31/2015
Hydrogen Sulfide (H_2S)	CAAQS	1-Hour (0.03 ppm/42 μg/m^3)	Attainment	---
Sulfates	CAAQS	24-Hour (25 μg/m^3)	Attainment	---
Vinyl Chloride	CAAQS	24-Hour (0.01 ppm/26 μg/m3)	Attainment	---

a) U.S. EPA often only declares Nonattainment areas; everywhere else is listed as Unclassifiable/Attainment or Unclassifiable

b) A design value below the NAAQS for data through the full year or smog season prior to the attainment date is typically required for attainment demonstration

c) 1-hour O_3 standard (0.12 ppm) was revoked, effective June 15, 2005 ; however, the Basin has not attained this standard based on 2008-2010 data and is still subject to anti-backsliding requirements

d) 1997 8-hour O_3 standard (0.08 ppm) was reduced (0.075 ppm), effective May 27, 2008; the revoked 1997 O_3 standard is still subject to anti-backsliding requirements

e) New NO_2 1-hour standard, effective August 2, 2010; attainment designations January 20, 2012; annual NO_2 standard retained

f) The 1971 annual and 24-hour SO_2 standards were revoked, effective August 23, 2010; however, these 1971 standards will remain in effect until one year after U.S. EPA promulgates area designations for the 2010 SO_2 1-hour standard. Area designations are still pending, with Basin expected to be designated Unclassifiable /Attainment.

g) Annual PM10 standard was revoked, effective December 18, 2006; 24-hour PM10 NAAQS deadline was 12/31/2006; SCAQMD request for attainment redesignation and PM10 maintenance plan was approved by U.S. EPA on June 26, 2013, effective July 26, 2013.

h) Attainment deadline for the 2006 24-Hour PM2.5 NAAQS (designation effective December 14, 2009) is December 31, 2019 (end of the 10th calendar year after effective date of designations for Serious nonattainment areas). Annual PM2.5 standard was revised on January 15, 2013, effective March 18, 2013, from 15 to 12 μg/m3. Designations effective April 15, 2015, so Serious area attainment deadline is December 31, 2025.

i) Partial Nonattainment designation – Los Angeles County portion of Basin only for near-source monitors. Expect redesignation to attainment based on current monitoring data.

Staff Report

South Coast 8-Hour Ozone SIP Update

Release Date: November 8, 2019
Hearing Date: December 12, 2019

CALIFORNIA AIR RESOURCES BOARD

This document has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the California Air Resources Board, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

Electronic copies from this document are available for download from the California Air Resources Board's website at: www.arb.ca.gov/planning/sip/sip.htm. In addition, written copies may be obtained from the Public Information Office, California Air Resources Board, 1001 I Street, 1st Floor, Visitors and Environmental Services Center, Sacramento, California 95814, (916) 322-2990.

For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette or computer disk. Please contact CARB's Disability Coordinator at (916) 323-4916 by voice or through the California Relay Services at 711, to place your request for disability services. If you are a person with limited English and would like to request interpreter services, please contact CARB's Bilingual Manager at (916) 323-7053.

For questions, contact:

Scott King, Ph.D., Air Pollution Specialist
South Coast Air Quality Planning Section
California Air Resources Board
P.O. Box 2815
Sacramento, California 95812

Phone: (916) 324-2831
Email: scott.king@arb.ca.gov

OR

Carol Sutkus, Manager
South Coast Air Quality Planning Section

Phone: (916) 322-1229
Email: carol.sutkus@arb.ca.gov

COMPLETENESS CHECKLIST FOR SIP REVISION

California State Implementation Plan
Revision to South Coast 8-hour Ozone State Implementation Plan
(Ozone SIP Update)

Planning Area: South Coast Air Basin

Title 40 CFR, Part 51, Appendix V Criteria for Determining the Completeness of Plan Submissions	Enclosed	Notes
2.1 ADMINISTRATIVE MATERIALS		
2.1(a) Submittal Letter from Governor's Designee	✓	Letter from Richard W. Corey, CARB Executive Officer, to Mike Stoker, U.S. EPA
2.1(b) Evidence of Adoption	✓	CARB Resolution #19-31
2.1(c) Legal Authority Citation	✓	CARB Resolution #19-31
2.1(d) Copy of: • Emission Inventories	✓	District *Contingency Measure Plan, Planning for Attainment of the 1997 80 ppb 8-hour Ozone Standard in the South Coast Air Basin*
2.1(e) Evidence of Compliance with State's Procedural Requirements	✓	CARB Resolution #19-31
2.1(f) Evidence of Public Notice Consistent with 40 CFR part 51.102	✓	CARB Notice of public meeting to consider the South Coast 8-hour Ozone Update
2.1(g) Certification of Public Hearing in Accordance with Notice	✓	CARB Resolution #19-31
2.1(h) Compilation of Public Comments and Responses	✓	CARB Public Comment enclosure
2.2 TECHNICAL SUPPORT		
2.2(a) Identification of Regulated Pollutant	✓	District *Contingency Measure Plan, Planning for Attainment of the 1997 80 ppb 8-hour Ozone Standard in the South Coast Air Basin*
2.2(b) Identification of Attainment Area/Status	✓	District *Contingency Measure Plan, Planning for Attainment of the 1997 80 ppb 8-hour Ozone Standard in the South Coast Air Basin*
2.2(c) Estimate of Impact on Emissions	✓	District *Contingency Measure Plan, Planning for Attainment of the 1997 80 ppb 8-hour Ozone Standard in the South Coast Air Basin*

2.2(d) Demonstration that Plan Protects NAAQS	✓	District *Contingency Measure Plan, Planning for Attainment of the 1997 80 ppb 8-hour Ozone Standard in the South Coast Air Basin*
2.2(e) Modeling Support	N/A	
2.2(h) Compliance/Enforcement	N/A	
2.2(i) Justification	N/A	

Table of Contents

[This page intentionally left blank.]

Executive Summary

On June 15, 2004, the South Coast Air Basin (South Coast) was designated nonattainment for the 80 part per billion (ppb) 8-hour ozone national ambient air quality standard (ozone standard), and ultimately classified as an extreme ozone nonattainment area. As an extreme area, the South Coast is required by the Clean Air Act (Act) to develop a State Implementation Plan (SIP) to achieve the ozone standard in 2023, the full ozone season prior to the attainment date of June 15, 2024. California prepared SIPs in 2007, 2012, and 2016 as part of its efforts to implement the ozone standard.

Most recently, the South Coast Air Quality Management District (District) *2016 Air Quality Management Plan* (2016 AQMP) included a SIP demonstrating attainment of the ozone standard in 2023. Air quality modeling in the 2016 AQMP projected that reaching the ozone standard would require significant emissions reductions in oxides of nitrogen (NOx). The 2016 AQMP ozone attainment strategy for 2023 was based on existing and new District control measures in addition to the California Air Resources Board (CARB) measures from the *2016 State Strategy for the State Implementation Plan* (State SIP Strategy). The State SIP Strategy provides the State's commitment to achieve emissions reductions in the South Coast by 2023 from mobile sources and consumer products.

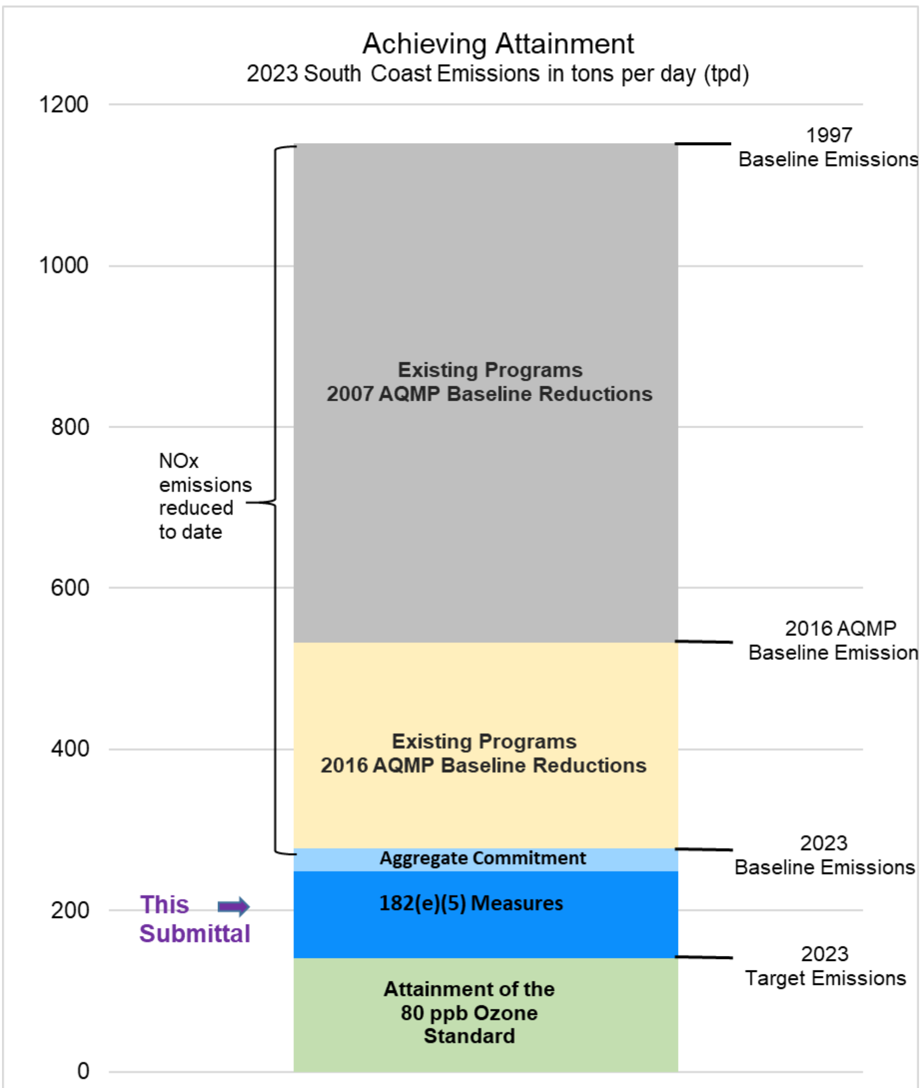
The Act includes a provision in Section 182(e)(5) specifically for extreme ozone nonattainment areas to rely in part on emissions reductions from measures that anticipate future technologies and control techniques will be developed and deployed in time to provide the emissions reductions needed for attainment. While the 2016 AQMP relied on reductions from existing regulations and defined measures for the majority of the emissions reductions needed to achieve the ozone standard, the last increment of emissions reductions needed for attainment utilized the Section 182(e)(5) advanced technology provision of the Act.

The Act also requires that areas utilizing Section 182(e)(5) measures include a commitment to submit a SIP update three years before the measures are needed. The SIP update must demonstrate that the area will achieve the emissions reductions assigned to the 182(e)(5) provision by the attainment date, or include contingency measures to be implemented if the anticipated technologies do not achieve the planned emissions reductions.

To meet the Section 182(e)(5)(B) requirement, the District and CARB staff developed the *Contingency Measure Plan, Planning for Attainment of the 1997 80 ppb 8-hour Ozone Standard in the South Coast Air Basin* (Ozone SIP Update). The Ozone SIP Update includes a joint CARB/District strategy to achieve the remaining NOx emissions reductions needed to achieve the ozone standard in 2023.

Figure ES-1 demonstrates the progress that CARB and the District have made reducing NOx emissions since the ozone standard was set in 1997. Since that time, CARB and District programs have reduced NOx emissions by 76 percent. The area marked "182(e)(5) Measures" is the subject of this SIP submittal and represents the final increment of emissions reductions needed to achieve the ozone standard.

Figure ES-1: NOx emissions in the South Coast since the 8-hour Ozone Standard was set



The Ozone SIP Update lays out an aggressive approach to achieve the final 108 tons per day (tpd) increment of NOx reductions needed to achieve the ozone standard. The Ozone SIP Update includes three specific elements. The first two of these elements describe the actions CARB and the District will take to achieve reductions. The last describes anticipated federal actions. Given the challenge, the South Coast cannot meet the ozone standard without timely federal action. Therefore, CARB and the District anticipate federal reductions will occur and so this submittal reflects those anticipated reductions:

1. Identified Emission Reduction Strategies – Since the adoption of the 2016 AQMP, CARB and the District have identified additional emissions reductions that can be credited toward the Section 182(e)(5) reduction commitments in 2023. These reductions are based on adopted regulations and new regulations or programs to be adopted by 2020, clean mobile source technologies being implemented which were not reflected in the 2023 emissions inventory, and a series of innovative new measures designed to achieve further reductions;

2. Additional Incentive Funding – Accelerating the penetration of the cleanest technologies into the current fleet of motor vehicles and other combustion technologies is key to achieving the necessary reductions. Emissions reductions from both existing and new sources of incentive funding are a key element of the plan to achieve the anticipated emissions reductions needed. The Ozone SIP Update sets out an approach for securing additional incentive funding; and

3. Federal sources and federal measures – Without further reductions from sources primarily subject to federal jurisdiction (i.e., ocean-going vessels (OGV), aircraft, locomotives, out-of-state trucks), which account for 36 percent of NOx emissions in the South Coast, attainment of the ozone standard is not possible by 2023. The Act allocated primary responsibility to control emissions to the states. And CARB and the District have exercised our authority to the fullest to secure emissions reductions with technology-forcing standards for mobile, industrial, and commercial sources. But the Act also recognizes that federal leadership is essential. Section 101(a)(4) of the Act specifies that Congress found that federal financial assistance and leadership is essential for the development of cooperative federal, state, regional, and local programs to prevent and control air pollutions. This is especially true since U.S. EPA retains excusive authority to regulate some of the most polluting sources in California. Therefore, the Ozone SIP Update outlines the federal actions, which would be needed for the region to achieve the standard by 2023, and which the District and CARB anticipate will occur based on U.S. EPA's authority to control emissions and responsibility to act as a good partner to achieve healthy air.

Table ES-1 shows the anticipated emissions reductions for the three elements of the Ozone SIP Update.

Table ES-1: Ozone SIP Update Elements

Plan Element	2023 Reductions (tpd)
1. Identified Emissions Reduction Strategies	24-26
2. Additional Incentive Funding	15
3. Federal Measures and/or Funding	67-69
Total	**108**

How does this submittal enhance the 2016 AQMP?

Implementation of the Act was intended to be a partnership with all levels of government participating. Further, Congress recognized that certain areas, such as the South Coast, face a greater air quality challenge and require a coordinated effort to clean up all source categories to meet air quality standards. States and local air districts can address many source categories, but have limited authority for some source categories. Federal action is needed to fully address these source categories, and reductions from these categories are key to success in meeting the ozone standard in the South Coast.

Since submittal of the 2016 AQMP, CARB and the District have been working hard to adopt the measures committed to in the 2016 AQMP for sources that we have the authority to control. But at the same time, as CARB and the District have done with all prior SIPs, we have continued to identify measures beyond those originally identified in the 2016 AQMP, including already adopted new regulations, to achieve additional emissions reductions. The new measures we have identified through that work that go beyond those in the 2016 AQMP are summarized in Table ES-2 and described in detail in Chapter 2.

Table ES-2: Identified Emission Reduction Strategies

	Agency	NOx Reductions (tpd)
RECLAIM BARCT Rules	South Coast AQMD	**2**
Ports MOU	South Coast AQMD	**3.2-5.2**
Airports MOU	South Coast AQMD	**0.5**
Metrolink Locomotives	South Coast AQMD	**3**
Incentives (Expected Future Funding)	South Coast AQMD	**1.5**
Low Carbon Fuel Standard and Alternative Diesel Fuels Regulation	CARB	**1.7**
ATCM for Portable Engines, Statewide Portable Equipment Registration Program	CARB	**0.25**
HD Inspection and Maintenance Program	CARB	**4.2**
Innovative New Measures: – **Tier 5 Off-Road Diesel Engine Standard** – **State Green Contracting** – **Reduction in Growth of Single-Occupancy Vehicle Travel** – **Locomotive Emission Reduction Measure** – **VMT and Land Conservation** – **Regional VMT Reductions** – **Co-benefits from Electrification of Buildings due to 2017 Climate Change Scoping Plan**	CARB and other agencies	**3**
Total Reductions Towards 182(e)(5) Commitment*		**24-26**

* Estimated reductions including 4.2 tpd of NOx reductions associated with updated OGV emissions inventory and CARB's SIP Strategy for OGV.

Emissions reductions from both existing and new sources of incentive funding are a key element of the plan to increase the penetration of the cleanest technologies and achieve the anticipated emissions reductions needed. Moving forward, through 2023, CARB and the District will advocate for several funding sources including: (1) additional Greenhouse Gas Reduction Funds (GGRF), (2) Statewide Bond Funding, and (3) Voting District Authorization for Clean Air Legislation, SB 732 (Allen), as described later. In addition, CARB and the District will continue working hard to explore all additional options to help secure sufficient funding to achieve the ozone standard in 2023.

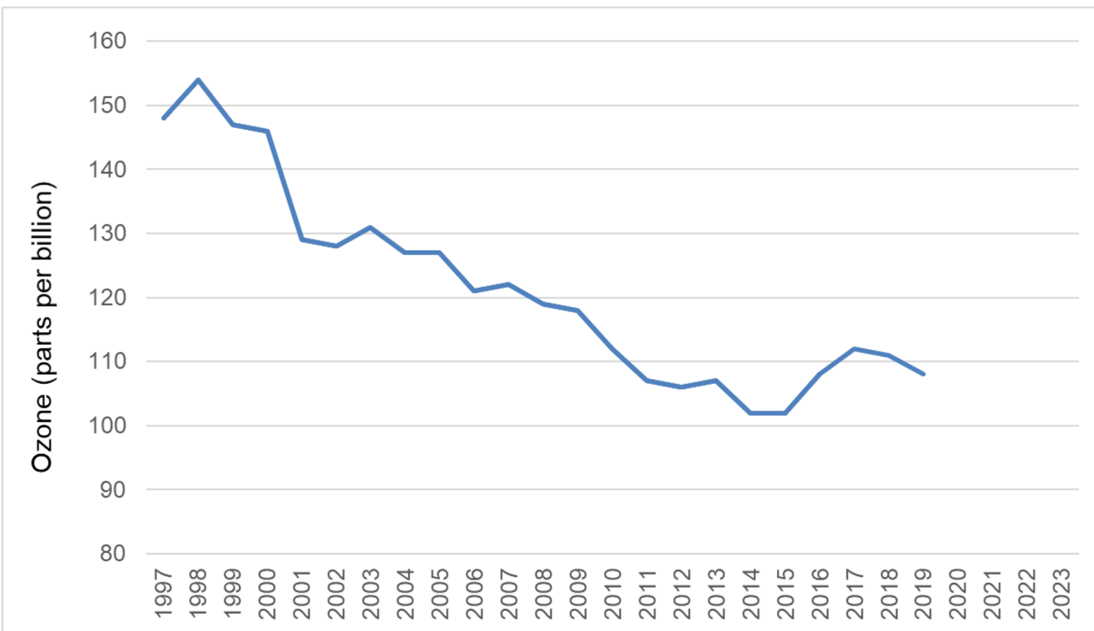
The remaining actions needed to complete the transition to cleaner technologies in all sectors and to achieve the necessary reductions by 2023 can be achieved through efforts at the federal level. To this end, CARB and the District anticipate U.S. EPA will adopt cleaner emissions standards for locomotives and heavy-duty trucks, among other sources under primarily federal control. California understands that U.S. EPA could also choose to achieve reductions by providing incentive funding to accelerate the transition to clean technologies. CARB and the district estimate that up to 78 tpd of reductions in NOx emissions could be achieved by transitioning sources under federal jurisdiction to the cleanest technologies in a timely manner. California believes that federal actions can produce the emissions reductions needed for attainment in 2023.

Inclusion of assumed reductions from actions by U.S. EPA in this Ozone SIP Update, do not constitute a legally binding requirement by California on U.S. EPA. We understand that as a matter of law that is not permitted. Rather, CARB and the District are making the reasonable assumption that U.S. EPA will fulfill its responsibilities under the Act in such a way and in time to allow California to meet its Act mandates. We note that if, due to federal inaction, we do not achieve the standard by 2023, the Act will require a new SIP setting a new attainment date, up to ten years later. As a contingency for federal inaction, California is already adopting regulations and planning for future regulations that will continue to reduce emissions beyond the current attainment date. We have included an analysis showing the actions CARB and the District anticipate taking in that circumstance.

Chapter 1 - Background

Ozone levels in the South Coast have declined by nearly a third since 1997 when the first 8-hour ozone standard of 80 parts per billion (ppb) (ozone standard) was set by U.S. EPA, Figure 1. While South Coast 8-hour ozone levels in the 1990s often exceeded 200 ppb, the South Coast has not had a monitored 8-hour ozone measurement over 200 ppb since 1998 or even over 150 ppb of ozone since 2003. With the exception of an uptick in ozone levels in recent years most likely due to unusual heat and drought conditions, South Coast was making significant progress towards attaining the ozone standard in 2023.

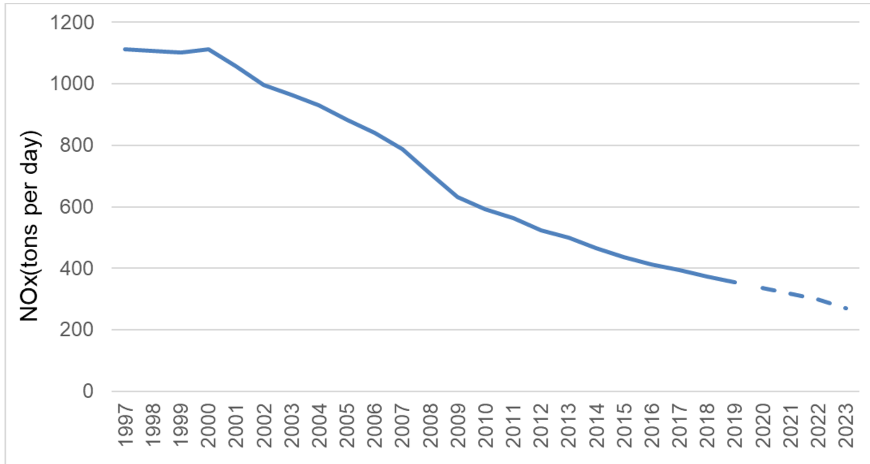
Figure 1: 8-hour Ozone Design Values in the South Coast from 1997 to 2019*



*2019 Ozone measurements are unofficial draft values, subject to change.

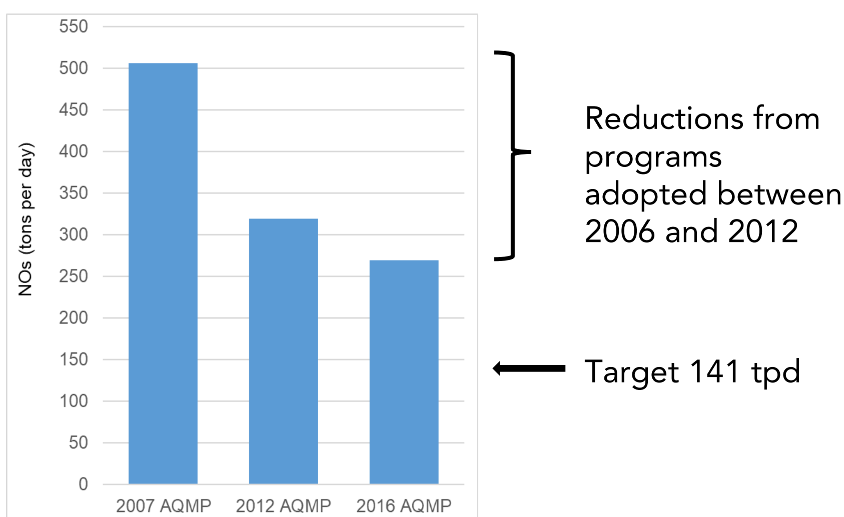
The improvement in air quality in the South Coast has been achieved through State and District programs primarily aimed at reducing NOx emissions. Total NOx emissions in the South Coast have decreased from well over 1100 tpd of NOx in 1997, when the 80 ppb 8-hour ozone standard was set, to 356 tpd today and is projected to be reduced to 269 tpd in 2023, Figure 2.

Figure 2: NOx emissions in the South Coast from 1997 to 2023



On November 28, 2007, CARB submitted the first SIP for the South Coast to achieve the ozone standard in 2023. The 2007 AQMP, 2012 AQMP, and 2016 AQMP all included emission inventories and detailed the steady progress that has been achieved by the District and the State in securing emissions reductions in NOx and reactive organic gases (ROG) emissions in 2023 from sources within the South Coast. The 2016 AQMP air quality modeling demonstrated that substantial NOx emissions reductions are key to reaching attainment. Figure 3 demonstrates how projected 2023 emissions in the South Coast have been reduced from adopted rules and programs (baseline emissions) in successive AQMPs. The 2016 AQMP emission inventory demonstrated that the NOx baseline emissions in 2023 have been reduced by nearly 50 percent from the 2023 NOx emissions in the 2007 AQMP, Figure 3.

Figure 3: 2023 baseline emissions in the South Coast from three successive AQMPs over nine years



Today, NOx emissions in the South Coast have been reduced by almost 70 percent since U.S. EPA set the ozone standard in 1997. The State has focused its efforts to reduce on-road and off-road mobile source emissions since the majority of the NOx emissions in the South Coast comes from these sources. In addition to stationary controls, the District's controls in the 2007 AQMP also focused on mobile source reductions.

CARB is implementing numerous regulations aimed at reducing NOx emissions from light–duty on-road vehicles such as cars, heavy-duty on-road vehicles such as diesel trucks, and off-road sources like forklifts and large construction equipment. Phased implementation of these regulations continue to lower emissions from mobile sources through 2023 and beyond as newer vehicles and engines are introduced with cleaner technologies, and the older, dirtier vehicles and engines are replaced. In addition to regulations targeting vehicles and other combustion sources, CARB is requiring cleaner fuels that provide for additional emissions reductions in vehicles and equipment. Further details of the State's mobile source program are provided in the Ozone SIP Update.

These State programs along with District stationary and area sources programs and incentive programs have reduced NOx emissions in the South Coast in 2023 to 269 tpd.

2016 AQMP Attainment Demonstration

The 2016 AQMP attainment demonstration specified that NOx emissions in the South Coast need to be reduced to a level of 141 tpd of NOx to achieve the ozone standard. As stated above, baseline NOx emissions in 2023 have been reduced to 269 tpd due to current regulations, leaving an additional 128 tpd of NOx emissions reductions to be achieved. The 2016 AQMP attainment strategy provides for these emissions reductions through traditional defined measures and measures utilizing Section 182(e)(5) of the Act, titled in the 2016 AQMP as Further Deployment of Cleaner Technologies as shown in Table 1.

Table 1: 2023 NOx Reductions Needed to Achieve the Ozone Standard

Total Emissions Reductions to Achieve the Ozone Standard	**128***
District Defined Measures	*23*
CARB Defined Measures	*4.3*
Further Deployment of Cleaner Technologies	*108*

*additional emissions reductions beyond 128 tpd are required to accommodate a 3 tpd set aside and an additional 4.2 tpd correction in the ocean-going vessel (OGV) emissions

On March 7, 2017, CARB adopted the State SIP Strategy to provide the emissions reductions needed to achieve the ozone standard in the South Coast. In the State SIP Strategy, CARB committed to providing 113 tpd of NOx reductions in the South Coast in 2023. These measures were separated into two types of commitments: defined measures that comprise an aggregate commitment and 108 tpd of NOx emissions reductions from further deployment of new technologies measures approved under Section 182(e)(5) of the Act.

Since adopting the State SIP Strategy, CARB has been hard at work implementing the measures that were defined in the State SIP Strategy according to the schedule set forth in the aggregate commitment. Several of these measures have been adopted by CARB and are detailed in Table 2. Other measures are in the development stage, either undergoing public workshops or staff concept development.

Table 2: 2016 State SIP Strategy Approved Aggregate Commitment Measures

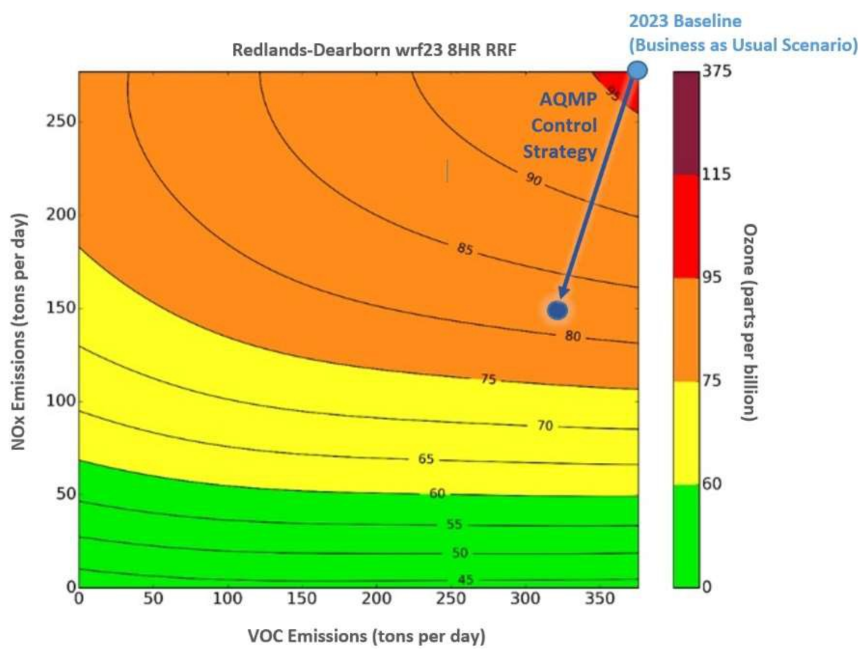
Measure Title	Board Adoption
South Coast On-Road Heavy Duty Vehicle Incentive Measure	March 22, 2018
Heavy-Duty Diesel Vehicle Emission Control System Warranty Regulation Amendments	June 28, 2018
Innovative Clean Transit Regulation	December 14, 2018
Zero-Emission Airport Shuttle Regulation	June 27, 2019
Zero-Emission Powertrain Certification Regulation	June 27, 2019
Electric Vehicle Supply Equipment Standards	June 27, 2019
Ocean-Going Vessel At Berth And At Anchor Regulation	Scheduled December, 2019

The further deployment of cleaner technology measures represent the remainder of the emissions reductions needed, 108 tpd of NOx. These measures include incentive programs to accelerate technology penetration in time to achieve the ozone standard and further federal actions to achieve emissions reductions from sources under federal and international regulatory authority.

In addition to committing to 113 tpd of NOx reductions in the 2023 ozone attainment strategy, reductions in ROG emissions were also included in the attainment demonstration as concurrent benefits from the State SIP Strategy measures. While these emissions reductions were included in the attainment demonstration in the 2016 AQMP, ROG reductions have limited effect on reducing 8-hour ozone levels in 2023 as determined by the air quality modeling and shown by the shape of the curve in Figure 4. Figure 4 demonstrates the relationship between the ozone precursors, NOx and ROG emissions and ozone levels, and demonstrates that reductions in NOx emissions are significantly more beneficial to reducing ozone levels in 2023 than are reductions in ROG emissions.

The Ozone SIP Update is required to address the NOx and ROG emissions in 2023 from further deployment of cleaner technology measures. As discussed above, reductions from measures targeting ROG emissions in 2023 will produce only a minor benefit to meeting the ozone standard. For this reason, the Ozone SIP Update focuses on NOx emissions reductions to provide for attainment of the ozone standard.

Figure 4: 2023 Isopleth of Redlands monitor in 2023 demonstrating NOx sensitivity



[This page intentionally left blank.]

Chapter 2- Contingency Measure Plan

Achieving the ozone standard in the South Coast by 2023 is a tremendous challenge. The State SIP Strategy demonstrated that reducing NOx emissions in the South Coast will require significant deployment of near-zero and zero-emission technologies including substantial levels of incentive funding needed to accelerate the turnover to these cleaner technologies. While CARB and the District continue to implement on-going and new control programs for the sources under California's control, U.S. EPA action is critical to reduce the NOx emissions from federal and international sources to the level necessary to achieve the ozone standard in 2023.

The proposed contingency measure plan discussed in the Ozone SIP Update and outlined in this report lays out an aggressive approach for achieving the 108 tons per day of NOx reductions allocated to "Further Deployment of Cleaner Technologies" under Section 182(e)(5) of the Act. The contingency management plan is comprised of three specific elements, as described below:

1. Identified Emission Reduction Strategies – Since the adoption of the 2016 AQMP, CARB and the District have identified additional emissions reductions that can be credited toward the Section 182(e)(5) reduction commitments in 2023. These reductions are based on adopted regulations and new regulations or programs to be adopted by 2020, clean mobile source technologies being implemented which were not reflected in the 2023 emissions inventory, and a series of innovative new measures designed to achieve further reductions;

2. Additional Incentive Funding – Accelerating the penetration of the cleanest technologies into the current fleet of motor vehicles and other combustion technologies is key to achieving the necessary reductions. Emissions reductions from both existing and new sources of incentive funding are a key element of the plan to achieve the anticipated emissions reductions needed. The Ozone SIP Update sets out an approach for securing additional incentive funding; and

3. Federal sources and federal measures – Without further reductions from sources primarily subject to federal jurisdiction (i.e., OGV, aircraft, locomotives, out-of-state trucks), which account for 36 percent of NOx emissions in the South Coast, attainment of the ozone standard is not possible by 2023. The Act allocated primary responsibility to control emissions to the states. And CARB and the District have exercised our authority to the fullest to secure emissions reductions with technology-forcing standards for mobile, industrial, and commercial sources. But the Act also recognizes that federal leadership is essential. Section 101(a)(4) of the Act specifies that Congress found that federal financial

assistance and leadership is essential for the development of cooperative federal, state, regional, and local programs to prevent and control air pollutions. This is especially true since U.S. EPA retains excusive authority to regulate some of the most polluting sources in California. Therefore, the Ozone SIP Update outlines the federal actions, which would be needed for the region to achieve the standard by 2023, and which the District and CARB anticipate will occur based on U.S. EPA's authority to control emissions and responsibility to act as a good partner to achieve healthy air.

Table 3 presents the anticipated emissions reductions for the contingency measure plan that is included in the Ozone SIP Update.

Table 3: Ozone SIP Update Contingency Measure Plan Elements

Plan Elements	2023 Reductions (tpd)
1. Identified Emissions Reduction Strategies	24-26
2. Additional Incentive Funding	15
3. Federal Measures and/or Funding	67-69
Total	**108**

Further detail for these three elements is provided below.

1) Identified Emissions Reduction Strategies

In addition to implementing the measures specified in the 2016 AQMP, CARB and District staffs have identified additional emissions reduction strategies needed to reach attainment. Table 4 lists the resulting newly identified strategies and the anticipated emissions reductions. These efforts have been, or will soon be, adopted. Reductions from these measures were not included in the 2023 ozone standard attainment demonstration in the 2016 AQMP. Altogether, these will provide up to 26 tpd of NOx reductions in 2023 with the District actions accounting for 10 to 12 tpd. Further detail on the strategies are provided below.

Table 4: Identified Emission Reduction Strategies

	Agency	NOx Reductions (tpd)
RECLAIM BARCT Rules	District	2
Ports MOU	District	3.2-5.2
Airports MOU	District	0.5
Metrolink Locomotives	District	3
Incentives (Expected Future Funding)	District	1.5
Low Carbon Fuel Standard and Alternative Diesel Fuels Regulation	CARB	1.7
ATCM for Portable Engines, Statewide Portable Equipment Registration Program	CARB	0.25
HD Inspection and Maintenance Program	CARB	4.2
Innovative New Measures	CARB	3
Total Reductions Towards 182(e)(5) Commitment*		**24-26**

* Estimated reductions including 4.2 tpd of NOx reductions associated with updated OGV emissions inventory and CARB's SIP Strategy for OGV.

District Identified Emission Reduction Strategy

RECLAIM BARCT Rules

Pursuant to directives listed in control measure CMB-05 of the 2016 AQMP and in recently adopted State statute (AB 617), the REgional CLean Air Incentives Market (RECLAIM) Program facilities are subject to an expedited implementation schedule to install additional best available retrofit control technology (BARCT) no later than December 31, 2023, which has accelerated the implementation schedule of CMB-05 from 2025 to 2023. In 2020, the District is scheduled to adopt rules implementing CMB-05 including Rule 1109.1 for refinery equipment, Rule 1150.3 for landfills and Rule 1179.1 for combustion equipment and publicly owned treatment work facilities.

Ports and Airports MOUs

On May 4, 2018, the District's Governing Board directed staff to pursue a voluntary Memorandum of Understanding (MOU) approach with marine ports and commercial airports and pursue regulatory approaches for warehouses/distribution centers, railyards and new and re-development. The MOUs with the marine ports and commercial airports will implement the facility-based mobile source measures MOB-01 and MOB-04 in the 2016 AQMP, with quantifiable emissions reductions. Reductions from these measures were not included in the 2016 AQMP ozone attainment demonstration.

Metrolink Locomotives

The District's Governing Board has awarded Metrolink a total of $101.85 million since February 2013 for the replacement of 37 older locomotives (Tier 0 and Tier 2) with Tier 4 locomotives and the new purchase of three Tier 4 locomotives. As of September 2019, 27 Tier 4 locomotives have been delivered to Metrolink with 23 units deployed in revenue service or undergoing testing to prepare for service. Metrolink anticipates all 40 Tier 4 locomotives will be deployed in service by the end of 2020.

Incentives (Expected Future Funding)

Additional NOx emissions reductions are anticipated from continued implementation of existing incentive programs with future funding also generating surplus reductions to the 2016 AQMP's 2023 commitments.

CARB Identified Emission Reduction Strategies – New Mobile Source Measures

Low Carbon Fuels Standard Amendment

On September 27, 2018, the Board approved amendments to the Low Carbon Fuel Standard (LCFS), which sets annual carbon intensity standards for gasoline, diesel, and the fuels that replace them consistent with California's 2030 GHG target enacted through SB32. The LCFS will lower GHGs and improve California's air quality by lowering statewide NOx and PM2.5 emissions from 2019 through 2030.

ATCM for Diesel Particulate Matter from Portable Engines Rated At 50 Horsepower and Greater, and the Statewide Portable Equipment Registration Program Regulation

On November 16, 2017, CARB approved amendments to the Portable Equipment ATCM and Portable Equipment Registration Program (PERP Regulation). The PERP Regulation requires operators to upgrade their equipment to meet emissions requirements by 2020. The latest PERP Regulation restructures the emissions requirements so that implementation and enforcement of the regulation is feasible and achieves NOx emissions reductions not anticipated in the 2016 AQMP.

Heavy Duty Truck Inspection and Maintenance Program

Scheduled for consideration by CARB in 2020, the Heavy-Duty Truck Inspection and Maintenance Program (HD I/M program) will incentivize vehicle owner and driver behavior to ensure that heavy-duty vehicles are well maintained and properly repaired. The HD I/M program will ensure that vehicles' emissions control systems are operating as designed to reduce emissions, and will also remove gross polluting HD vehicles from the roads.

CARB Identified Emission Reduction Strategies – Innovative New Measures

In addition to the regulations identified above, CARB has identified additional innovative new measures. The innovative new measures represents the next step to achieving more reductions at the State level and go beyond those regulations identified above. These actions, in some cases, go beyond the historical model of programs and regulations and represent the level of transformation needed from every sector to achieve clean air. These measures are listed in Table 5 and further detailed is provided below.

The Innovative New Measures represent a new SIP commitment by the Board.

Table 5: CARB Innovative New Measures

Innovative New Measures	Reductions
Tier 5 Off-Road Diesel Engine Standard	**3.0**
State Green Contracting	
Reduction in Growth of Single-Occupancy Vehicle Travel	
Locomotive Emission Reduction Measure	
Regional VMT Reductions	
VMT and Land Conservation	
Co-benefits from Electrification of Buildings due to 2017 Climate Change Scoping Plan	

Tier 5 Off-Road Diesel Engine Standard

Since 1995, CARB has adopted four increasingly stringent tiers of engine standards to reduce emissions and adverse health effects from off-road diesel engines. However, it has been almost 14 years since the off-road diesel emissions standards were last updated (Tier 4 in 2005), which now lag behind the European Stage V nonroad diesel standards in stringency. As a result, the emissions contribution from off-road diesel engines continues to increase and will exceed the contribution from on-road diesel engines by 2025, making off-road diesel the single largest source of mobile NOx emissions in California. This measure would include adopting more-stringent engine standards that reduce NOx and PM emissions by up to 90 percent below the current Tier 4 engine standards, as well as potential requirements to offer off-road vehicles with zero-emission technology for sale.

State Green Contracting

California's State Transportation Agency (i.e. Caltrans) spends approximately $5 billion annually on building and maintaining California roads. In addition, State government purchases new vehicles and equipment each year. This measure would consider requiring that contractors use the cleanest equipment available in order to be considered for these government contracts and that State agencies purchase the cleanest vehicles and equipment that are available. This measure builds on Governor Newsom's recent directive for State government to immediately redouble efforts to reduce greenhouse gas emissions and mitigate the impacts of climate change while building a sustainable, inclusive economy.

Reduction in Growth of Single-Occupancy Vehicle Travel

This measure would consider applying a regional transportation system pricing program in conjunction with requirements to use funding generated to encourage people to take public transit, carpool, bike, walk, and/or adjust trip times at congested times of day. The regional pricing program would implement a suite of regional and locally focused pricing strategies for use of certain lanes, driving into certain areas, parking in prime locations, driving at peak times, and/or utilizing non-pooled ride hailing services. Funds generated from the program must be used to either encourage use of existing identified clean transportation options or to provide additional clean transportation options. Some examples include, but are not limited to: reducing the cost of transit via transit passes, providing rebates for e-bikes, providing lower cost or reserved parking spaces for carpools, educating the public about the availability of per-mile car insurance pricing options, and provide traveler incentives to encourage travel at times when roads are less congested.

Locomotive Emission Reduction Measure

CARB is evaluating concepts for a potential regulation to reduce criteria, toxics, and greenhouse gas emissions from locomotives. These concepts address in-use locomotive emissions, idling, and maintenance activities. The potential regulation includes elements that could be implemented at the State and/or District level. Previously, State action to limit rail emissions has been through enforceable agreements. Although a regulation will take more time to implement than an agreement, it will not sunset like previous MOUs, it will be more transparent in its development, it will be enforceable, and it will achieve additional emissions reductions.

Specifically, one of CARB's concepts, called the Locomotive Emissions Reduction Spending Account (Account) requires that the Class 1 railroads set aside funds each year to purchase Tier 4 or cleaner locomotives. The amount to be set aside is based on the usage of Tier 3 and lower (dirtier) locomotives in California. The charge increases with the emissions level of the locomotive used, which should encourage cleaner locomotive operation within the State. The Account could begin implementation by the end of 2022, with potential PM and NOx reductions by the end of 2023. CARB staff will coordinate with the District to ensure this measure does not duplicate the District's railyard indirect source rule.

VMT and Land Conservation

Integrating land and transportation strategies can have synergistic effects and help the state further reduce both criteria and greenhouse gas emissions by protecting land-based carbon while providing simultaneous reductions in emissions from transportation. Protection of lands that are at risk of conversion to urban or rural development through use of conservation easements or the implementation of local and regional planning policies that protect land from development result in the extinguishment of development rights, thereby avoiding increases in vehicle miles traveled (VMT) by limiting opportunities for expansive, vehicle-dependent forms of development. Currently, only some sustainable community strategies in regional transportation plans explicitly include conservation and management of natural and working lands. While cities and counties across California have developed local and county climate action plans to reduce GHG emissions and increase climate resilience, few capture the potential GHG reductions from conserving, restoring, and managing natural working lands. Although limited research is available on the direct effect of land conservation on VMT, the State is expanding efforts to understand the relationship and synergies of taking an integrated cross-sector approach.

Regional VMT Reductions

Today's California is shaped by historic patterns of growth in transportation and housing. While we have grown to be the fifth largest economy in the world, our residents, in search of an affordable place to live, and with insufficient transportation options, are too often left with little choice but to spend significant time and money driving from place to place. Where we put transportation and housing also imposes and often reinforces long-standing racial and economic injustices by placing a disproportionate burden on low-income residents, who end up paying the highest proportion of their wages for housing and commuting. Staff and elected officials of local, sub-regional, regional, and State government bodies all have critical authorities and roles to contribute and could take steps to improve these outcomes, but so far, all –

acting rationally within the State's current structure of incentives, political forces, and policy restrictions – have not been able to enact the magnitude of change needed. There are unique opportunities for elected officials to improve mobility options within the transportation sector to reduce emissions and help with attainment of health-based air quality standards in the South Coast.

Co-Benefits from Electrification of Buildings due to 2017 Climate Change Scoping Plan

Buildings contribute directly to emissions when fuel (primarily natural gas) is combusted on-site for space and water heating. As grid electricity in California transitions to 100 percent clean energy, building electrification can reduce fuel combustion emissions in buildings. The framework for this measure is contained in Alternative 1 of the 2017 Climate Change Scoping Plan adopted by the CARB Board in 2017, and includes measures pertaining to appliance technology substitution; demand reduction; and electrical efficiency in industry, agriculture, residential, and commercial lighting; and residential air conditioning, freezing, and refrigeration. An implementation framework for building electrification would consider mechanisms to require and incentivize early retirement/replacement and new installations of residential and commercial water heating, space heating, and air conditioning appliances with zero or near-zero emission technologies such as high efficiency electric heat pumps.

2) Additional Incentive Funding

The 2016 AQMP demonstrated that attainment of the ozone standard in 2023 would require over $1 billion per year in incentive funding for clean vehicles through 2023. This represents a substantial increase in funding beyond traditional incentive programs, and new incentive programs are being developed to provide the needed funding.

Recent programs that will provide continued incentive funding include AB 1274 (O'Donnell) that creates annual smog abatement fees that are transferred to the Carl Moyer Program. This bill is anticipated to create a sustainable funding source of about $25-30 million annually for the South Coast.

Moving forward, through 2023, CARB and the District will advocate for several funding sources including: (1) additional Greenhouse Gas Reduction Funds (GGRF), (2) Statewide Bond Funding, and (3) Voting District Authorization for Clean Air Legislation, SB 732 (Allen), as described below. In addition, CARB and the District will continue working hard to explore all additional options to help secure sufficient funding to achieve the ozone standard in 2023.

1. GGRF - Given that the South Coast already has three approved communities in the AB 617 program and is likely to add 2 more in 2020, the District will be advocating for at least $150 to $200 million in sustainable annual GGRF monies for incentive funding going forward, to benefit disadvantaged communities within the South Coast that are in the AB 617 program or are being considered for that program in future years.

2. Statewide Bond Funding – Currently, there are multiple pieces of State legislation that would result in bond measures for the statewide ballot (e.g. AB 352 (E. Garcia); AB 1298 (Mullin); and SB 45 (Allen)), that include funding at around the $4 billion level, for purposes that include the funding of zero and near-zero emission vehicle technologies and infrastructure. These bills are expected to be consolidated into one primary bond bill in 2020 and represent a substantial potential source of incentive funding to benefit air quality within the South Coast. District staff will be working with the California Air Pollution Control Officers Association to secure a portion of these bond monies for incentive funding for local air districts, including in the South Coast, to reduce air pollution and facilitate attainment of federal air quality standards.

3. Voting District Authorization for Clean Air Legislation, SB 732 (Allen) – The District is currently sponsoring State legislation, SB 732 (Allen), which seeks authorization from the Legislature to create a voting district in the South Coast to allow local funding measures to be placed on the ballot. The bill allows the people of the South Coast to decide for themselves whether they want to invest in clean air and address climate change. Once the bill passes the State legislature and is signed into law, it would allow a sales tax measure to be put on a ballot within the South Coast, either by voter initiative or by District Board action.

   This bill could result in the South Coast receiving a sustainable source of funding (estimated $1.4 billion dollars per year) to be used primarily for incentive funding for clean vehicles, infrastructure and equipment to facilitate implementation of the 2016 AQMP and future AQMPs within the South Coast.

3) Reductions from Federal Sources

Despite the many actions being taken by the District and CARB, the contribution of emissions from interstate sources coupled with limitations on regulatory authority over large and growing emissions from several off-road sources mean that achieving emissions reductions necessary to achieve federal standards will also require strong action at the federal level. CARB and the District continue to work with federal and international agencies to advocate for more stringent emission standards for sources that are not under State and local regulatory purview, but federal action is still forthcoming.

Emissions from sources subject to federal jurisdiction and international sources are either increasing or not keeping pace with reductions in other sectors in the South Coast. The following actions regarding sources under federal and international control are needed to usher in the cleanest technology and reduce emissions from these sources. These measures represent the transition to cleaner technologies that is needed in all sectors to achieve the goals set forth in this document and to achieve air quality standards in the future. The estimated emissions reductions in Table 6 from these measures represent complete transitions of these fleets and the maximum potential reductions from these sources. Thus, the measures may achieve more reductions than necessary to meet the standard if every single measure were implemented to the maximum extent. California understands that U.S. EPA could also choose to achieve reductions by providing incentive funding to accelerate the transition to clean technologies. At a minimum, some combination of these federal measures are necessary, through regulations, incentives or other means, for California to achieve the final increment of emissions reductions needed to meet the ozone standard, Table 6.

Table 6: Reductions from Federal and International Sources

Measures	Measure Description	2023 NOx Reductions (tpd)
Low-NOx Heavy-Duty Vehicles	Heavy-duty vehicles (above 14,000 lbs. GVWR) powered by low-NOx standard in 2023	**Up to 35**
Low-NOx Ocean-Going Vessels	Ocean-going vessels coming to California powered by Tier 3 engines in 2023	**Up to 28**
Low-NOx Locomotives	Locomotives coming to California powered by Tier 4 engines in 2023	**Up to 11**
Low-NOx Aircraft	Aircraft NOx reduced 20% from 2012 levels	**Up to 4**
Total Reductions		**Up to 78**

The Ozone SIP Update will produce emissions reductions sufficient to achieve the 108 tpd of NOx reductions allocated to "Further Deployment of Cleaner Technologies" measures approved under Section 182(e)(5) of the Act.

Environmental Impacts

The District, as Lead Agency under the California Environmental Quality Act (CEQA), has reviewed the project pursuant to CEQA and the CEQA Guidelines. Pursuant to CEQA Guidelines section 15168, the District determined that the proposed Ozone SIP Update is considered a later activity within the scope of the programmatic project covered by the March 2017 Final Program Environmental Impact Report (PEIR) for the 2016 AQMP. It made this determination because no substantial changes or revisions to the project are necessary and no new significant environmental effects and no substantial increase in the severity of previously identified significant effects will occur as result of this later activity. As such, in accordance with CEQA Guidelines Section 15168(e)(2), the District found that the March 2017 Final PEIR for the 2016 AQMP adequately describes and analyzes the environmental effects of the project for the purposes of CEQA. Thus, the District found that no new environmental document is required pursuant to CEQA Guidelines Section 15168(c) and no subsequent CEQA document is required pursuant to CEQA Guidelines Section 15162.

To bolster its determination, the District found that the District adequately adopted mitigation measures in the March 2017 Final PEIR and made those measures a condition of approval of the 2016 AQMP. The District required and adopted an adequate Mitigation, Monitoring, and Reporting Plan, pursuant to Public Resources Code Section 21081.6 and CEQA Guidelines Section 15097, for the 2016 AQMP. Given the existing, adequate mitigation measures, the District found that it was not necessary to impose new or modified mitigation measures as a condition of the approval of this later activity, the proposed Ozone SIP Update. Further, the mitigation measures that were made a condition of approval of the 2016 AQMP as analyzed in the March 2017 Final PEIR and the corresponding Mitigation, Monitoring, and Reporting Plan that was adopted at that time will remain in effect through the life of the proposed project under consideration. In addition, Findings pursuant to CEQA Guidelines Section 15091 and a Statement of Overriding Considerations pursuant to CEQA Guidelines Section 15093 which were required and adopted for the 2016 AQMP, will remain in effect and applicable to the proposed project.

Since the District is the lead agency under CEQA, CARB acts as a responsible agency when it considers approving the proposed project. (CEQA Guidelines § 15096.) CEQA Guidelines, section 15096 dictates the responsible agency's role when reviewing a project that has been approved by a lead agency. Specifically, CARB must consider the environmental effects of the project as shown in the District's March 2017 Final PEIR prior to reaching a decision on the project. Under section 15096 of the CEQA Guidelines, if CARB finds that there are aspects of the EIR that do not adequately analyze the components of the Proposed Project that are within its authority to carry out, like the CARB measures, then CARB "shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment."

After considering the March 2017 Final PEIR, there does not appear to be any additional alternatives or feasible mitigation measures within CARB's powers that would substantially lessen or avoid any significant effects that those parts of the project which it carries out would have on the environment. Specifically, the District's mitigation measures that it included in its March 2017 Final PEIR, identified in table 1.9-1, and the findings supporting its statement of overriding considerations adequately address impacts associated with CARB's measures in the proposed project. Many of the significant and unavoidable impacts triggering the statement of overriding considerations are not mitigable because the power to mitigate the impacts lies with other jurisdictions, not CARB or the District. Therefore, upon CARB's consideration of the March 2017 Final PEIR, as expressed in the associated resolution for this Board item, its approval of the proposed project would comply with its responsible agency requirements under CEQA Guidelines section 15096.

Chapter 3 – Conclusion and Recommendations

Conclusion

The Ozone SIP Update satisfies the requirements of Section 182(e)(5) of the Act, and articulates the joint strategy by the District and CARB for achieving the 108 tons per day of NOx reductions allocated to Section 182(e)(5) measures in the 2016 AQMP. The Ozone SIP Update calls for newly identified emission reduction strategies and innovative new measures; additional incentive funding to transition to the cleanest available technologies; and significant federal action and/or funding to achieve the required reductions from sources under federal responsibility. These reductions will achieve attainment of the ozone standard in 2023.

Staff Recommendations

The Ozone SIP Update satisfies the requirements of Section 182(e)(5) of the Act. CARB staff recommends that the Board adopt the Ozone SIP Update including the new commitment to develop the proposed Innovative New Measures, and direct the Executive Officer to submit it to U.S. EPA as a revision to the California SIP.

CALIFORNIA
AIR RESOURCES BOARD

1001 I Street
P.O. Box 2815
Sacramento, CA 95812
www.arb.ca.gov

WHITE PAPER

AUGUST 2019

ESTIMATING THE INFRASTRUCTURE NEEDS AND COSTS FOR THE LAUNCH OF ZERO-EMISSION TRUCKS

Dale Hall, Nic Lutsey

THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

www.theicct.org

communications@theicct.org

ACKNOWLEDGEMENTS

This work is conducted with generous support from the Aspen Global Change Institute. Michael Nicholas provided key background research and data inputs on charging infrastructure assumptions. Critical reviews on an earlier version of this report were provided by Oscar Delgado, Felipe Rodriguez, and Ben Sharpe. Any errors are the authors' own.

International Council on Clean Transportation
1500 K Street NW Suite 650
Washington DC 20005 USA

communications@theicct.org | www.theicct.org | @TheICCT

EXECUTIVE SUMMARY

The transition to zero-emission commercial trucks holds great promise. Although heavy-duty electrification is in the early stages, the pace of development could progress quickly. Innovation in battery technologies, cost reductions from potential economies of scale, and development of high-power charging stations can provide a foundation for commercial trucks to follow the path of electric passenger cars. Incremental growth is made further feasible by the ability of commercial fleets to incorporate fuel savings in purchasing decisions, as well as to precisely plan infrastructure for company-specific operations.

This report quantifies the infrastructure needs and associated costs for implementing battery electric and hydrogen fuel cell trucks in three applications: long-haul intercity tractor-trailers, drayage trucks, and medium-duty delivery trucks. We focus on vehicles operating from the greater Los Angeles, California, region, where interest in these technologies has been concentrated. We evaluate the amount of charging and hydrogen refueling infrastructure required to sustain low-, medium-, and high-volume deployments in each of these applications, we estimate the costs of this infrastructure for fleets or the public, and assess financial implications for the transition to zero-emission trucks.

Table ES-1 summarizes the charging requirements and costs as the number of trucks increases from 100 to 1,000 to 10,000 in each of the three applications. The total infrastructure costs are substantial, into the hundreds of millions of dollars to reach 10,000 electric trucks for each of the three applications. However, infrastructure costs per vehicle decline as truck volume grows. The last column shows that, even if fleets were to bear these associated infrastructure costs, the overall vehicle ownership cost of electric trucks in these applications will generally be lower than conventional vehicle costs by 2030. Public infrastructure funding or other fiscal incentives could further improve the cost of ownership proposition. Although we highlight only the electric truck findings in this table, equivalent findings for hydrogen fuel cell trucks are also assessed in the report.

Table ES-1. Charging infrastructure for increasing electric truck volume in three applications

Application	Case	Number of trucks	Charging outlets	Infrastructure cost per truck (thousand)	Vehicle ownership cost versus diesel
Delivery (Class 6, 9.75-13 tons)	Low volume	100	130	$82	0% to +5%
	Medium volume	1,000	820	$40	-15% to -10%
	High volume	10,000	6,300	$27	-25% to -20%
Drayage (Class 7-8, 13+ tons)	Low volume	100	100	$58	+10% to +25%
	Medium volume	1,000	810	$38	0% to +5%
	High volume	10,000	7,300	$28	-15% to -10%
Long haul (Class 8, 16.5+ tons)	Low volume	100	150	$189	+13% to +18%
	Medium volume	1,000	1,200	$114	+5% to +10%
	High volume	10,000	9,700	$71	-5% to 0%

From this analysis, we draw the following conclusions.

Declining technology costs are making zero-emission trucks increasingly cost-competitive with conventional diesel vehicles. Although zero-emission trucks are more expensive in the near-term than their diesel equivalents, electric trucks will be less expensive than diesel in the 2025–2030 time frame, due to declining costs of batteries and electric motors as well as increasing diesel truck costs due to emission standards compliance. This analysis identifies additional obstacles, such as charging time and reduced cargo capacity, which could also add costs for fleets; however, electric trucks are expected to be cost-competitive even with these costs. Fuel cell trucks will also become less expensive in upfront vehicle cost and total cost of ownership by 2030.

Infrastructure costs are significant, but do not fundamentally impede the viability of zero-emission trucks. Whether constructed by fleets, third parties, or public agencies, charging and hydrogen infrastructure for zero-emission trucks pose significant costs. As fleets deploy the technologies at greater scale, infrastructure costs add more than $70,000 per battery electric long-haul tractor-trailer and more than $25,000 per drayage truck or delivery truck, amounting to 7% to 9% of the lifetime operating cost in each application. If these infrastructure costs are excluded, electric fleets could see vehicle ownership cost parity with diesel in the early 2020s; including these infrastructure costs pushes parity five to 10 years later.

Initial infrastructure buildouts will be costly without careful planning and coordination. In the early zero-emission truck deployments, it will be essential to plan infrastructure for specific routes, applications, and duty cycles to minimize costs. For electric trucks, overnight and loading area charging can greatly reduce charging costs, and coordination among fleets and public agencies could help distribute the initial costs. Government-led programs and public-private partnerships would help coordinate and share such investments.

Policy will be needed to spur this transition to zero-emission trucks. This analysis is focused on the shift from hundreds to tens of thousands of zero-emission trucks in three freight applications. To move through these steps, new zero-emission truck models need to be developed and improved, with continued investments to bring the greater volume and lower costs that are assumed in this analysis. Policy changes, such as the zero-emission truck regulation that California is considering, as well as public support for infrastructure, could spur the changes assessed in this report to occur within 10 years; without such policy and support, it could take decades.

This analysis finds encouraging evidence for the feasibility of zero-emission trucks, but also an indication of the substantial scale of investment needed. The findings also indicate numerous opportunities for continuing research. Because duty cycles and vehicle fleets vary widely among and within countries, additional analyses will be needed to determine costs in different regions. Another type of zero-emission trucks, e-roads powered by catenary lines, could also be considered for applications with concentrated traffic and high power use. Despite substantial costs and uncertainties, it is evident that zero-emission trucks, and the many air quality and climate benefits they will bring, are on the way.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Increasingly, manufacturer announcements and fleet deployments are raising the prospects for zero-emission trucks. There are now more than 100 zero-emission truck models in commercial truck segments, and these are being deployed in increasingly larger numbers. Zero-emission technologies are being developed by a combination of different players, including established manufacturers and suppliers, start-ups, and newly formed partnerships between companies. Aligned with this activity, companies have announced commitments to high-volume purchase of these vehicles and the transition of their fleets toward zero emissions in the years ahead. Zero-emission heavy-duty truck technology is clearly emerging, in a similar way to electric passenger vehicle technology six to eight years earlier.

Freight activity from diesel-powered trucks continues to grow, posing air-quality risks and representing an increasing share of greenhouse gas emissions, as shown in Figure 1. By 2040, medium- and heavy-duty vehicles are expected to be the largest fraction of transport-sector emissions as activity grows and other sectors become more efficient and shift to alternative fuels (International Energy Agency, 2017). Furthermore, diesel-powered trucks disproportionately contribute to air pollution, especially nitrous oxides (NOx) and particulate matter (PM), which cause a wide range of health problems, including asthma and cancer. A recent study found that large trucks are the largest contributor to PM pollution in areas near roadways in North America (Wang et al., 2018).

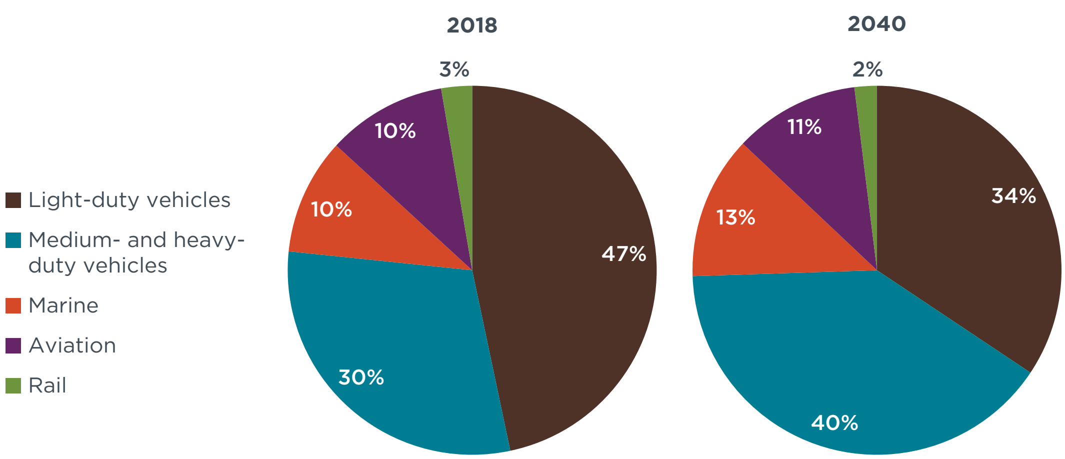


Figure 1. Global transport-sector greenhouse gas emissions by mode

Zero-emission trucks that could potentially reverse these emission trends are currently in the early stages of development, and research illustrates that these vehicles may soon become competitive with conventional alternatives. Moultak, Lutsey, and Hall (2017) found that the total cost of ownership (TCO) of zero-emission Class 8 trucks, including e-roads and hydrogen fuel cells, could fall below that of diesel trucks as soon as 2025 while also reducing emissions by 75%. A European Union-focused report finds that battery electric trucks with a range up to 300 miles (480 kilometers) are already competitive on a TCO basis with best-in-class diesel trucks, with future cost reductions expected (Earl et al., 2018). Other research projects that battery electric trucks for most freight applications will reach TCO parity with diesel in the 2030 range, with some smaller regional applications as soon as 2020 (Tryggestad, Charma, van de Staaij, & Keizer, 2017).

Major truck manufacturers are beginning to demonstrate and produce zero-emission trucks across the medium- and heavy-duty market. Figure 2 illustrates announced or in-production battery electric and hydrogen fuel cell freight trucks. The vertical axis shows the gross vehicle weight rating (GVWR) categories and corresponding U.S. vehicle classes 4 through 8. The horizontal axis shows the announced battery or hydrogen tank range in miles. Battery electric trucks are indicated by the blue markers, while the hydrogen fuel cell trucks are in green. Trucks of either technology that are in production or expected to be in 2019 are indicated as filled-in data points; those with expected production start dates beyond 2020, or not yet announced, are hollow data points. Additional details on these vehicles are listed in the Appendix.

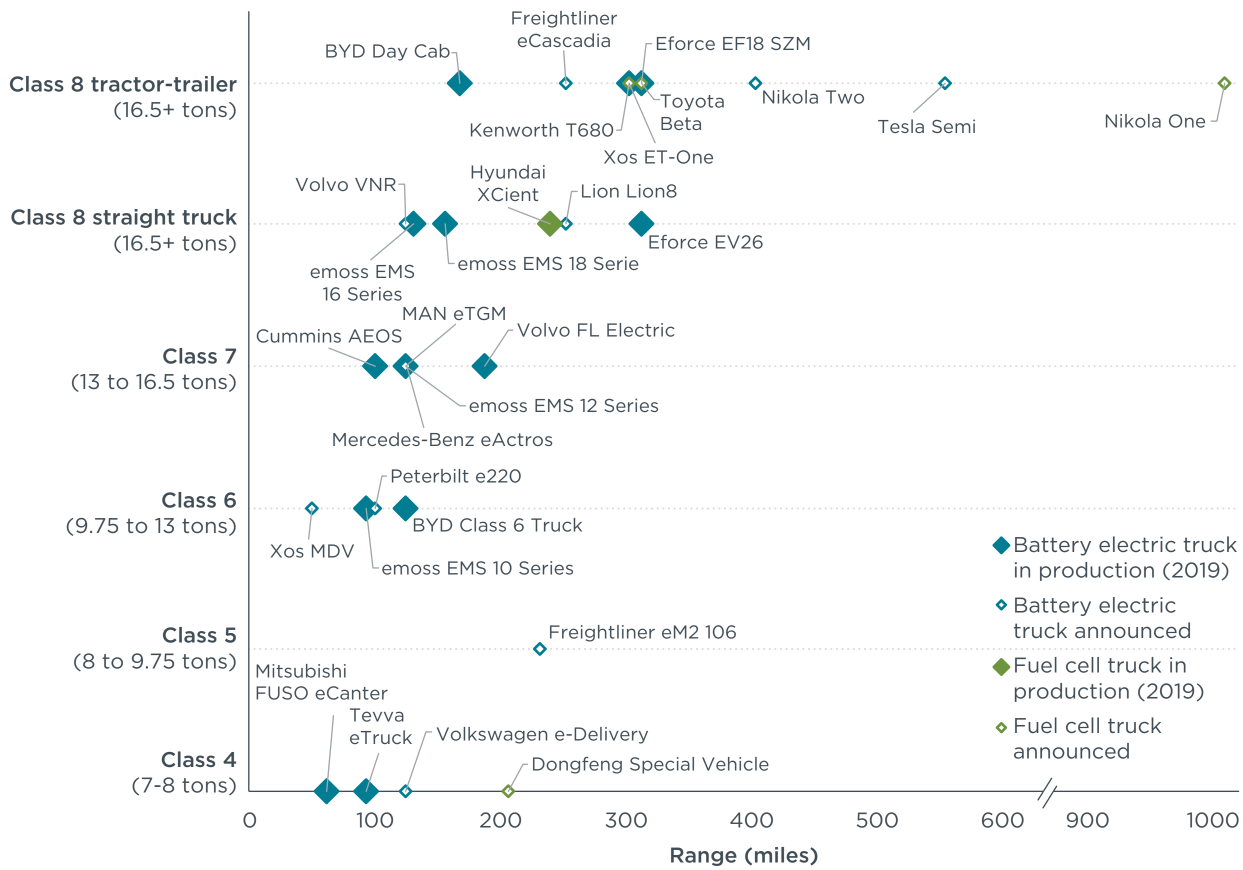


Figure 2. Range and GVWR class of announced or in-production zero-emission trucks

This figure, although not exhaustive, indicates that there is significant activity in commercializing zero-emission trucks, both from established global truck manufacturers as well as from newer start-up companies. Based on company announcements, there are at least 10 heavy-duty (Class 7 or Class 8, 13+ tons) models of battery electric trucks with a range of up to 550 miles that are slated for commercial deployment by 2021. Several trucks will directly compete in terms of range and weight (for example, three Class 6 electric trucks have been announced with a 150-mile range). Although there has been more activity on battery electric trucks to date, large manufacturers are also exploring fuel cells for the most demanding truck segments as well. A number of these zero-emission trucks, including from BYD, emoss, Mitsubishi FUSO, and Hyundai, have already entered production and are serving in fleets. In addition to these two technologies, other truck manufacturers are working on e-roads capable of dynamically powering trucks through catenary lines, on-road rails, or induction. Siemens, Volvo, and Scania are among the major companies investing in e-road technology, and are experimenting with different vehicle configurations that include batteries and diesel, natural gas, or hydrogen range extenders.

The transition to zero-emission commercial heavy-duty vehicles could take decades and potentially be considerably slower than for passenger cars due to the technology, operational, and infrastructure requirements. If the heavy-duty vehicles suffer from any volume or mass penalties, this would compromise the cargo-hauling capabilities. Many heavy-duty vehicles are driven 400 to 1,000 miles per day, which would require larger, more durable battery packs, adding to the cost and mass of the vehicle. In addition, they would require much faster charging options, battery swapping, on-road charging, or a network of hydrogen refueling solutions to accommodate their commercial operations.

Despite the issues outlined above, the pace of development could progress more rapidly. Innovation in battery technologies, cost reductions from potential economies of scale, and experience with high-power charging stations from electric bus adoption provide a foundation on which to build. Further, commercial fleets could incorporate fuel savings over a full vehicle ownership cycle in the vehicle purchase decision. In addition, fleet owners have the ability to provide their own charging infrastructure solutions for their company-specific operations with known parking locations. These factors make incremental growth increasingly possible for zero-emission commercial trucks to progress from pilot fleets, to niche operations, to medium-sized fleets with prescribed short-haul operations in the years ahead.

Although there is a strong research base for estimating the vehicle-level technologies, there is limited available research to quantify the infrastructure necessary for the operation of zero-emission trucks. This infrastructure—whether battery electric fast-charging stations, hydrogen refueling stations, or overhead catenary lines—has the potential to add significant costs and logistical hurdles for zero-emission trucks. The infrastructure needs are likely to vary widely depending on the vehicle type, drivetrain, duty cycle, typical cargo, and weight capacity of the trucks. Some early research estimates that the additional infrastructure costs for zero-emission trucks in Germany, if financed fully by the truck operators, could add 10% to 25% to the per-truck cost, raising the total cost of ownership above that of diesel (Kühnel, Hacker, & Görz, 2018). Deeper analysis is warranted on the specific infrastructure needs and associated costs for vehicles in different market segments and regions as zero-emission trucks are increasingly deployed.

This white paper seeks to address the gap in research by quantifying the infrastructure needed to supply freight trucks in three applications: long-haul tractor-trailers, drayage trucks operating out of a container port, and medium-duty delivery trucks. Although e-roads may play an important role in decarbonizing road freight, we found that data on the associated costs was less available, and we also view the technology as less applicable for medium-duty urban distribution applications. We therefore focus on battery electric and hydrogen fuel cell technologies. This analysis is tailored to the greater Los Angeles, California, region, where there is significant commercial interest in zero-emission vehicles to reduce both freight costs and air pollution. For each application, the zero-emission truck infrastructure needs are analyzed for small, near-term deployments up to large-scale commercialization. We then discuss the contribution of the infrastructure cost, whether borne by fleet operators or by government, to the overall cost of transitioning to zero-emission trucks.

METHODOLOGY

This paper considers the infrastructure needs for zero-emission vehicles operating in three vehicle applications in the greater Los Angeles area. The Los Angeles area geography helps to define the basis for all the technical specifications, fleet operation, route distances, and fueling costs, but the analysis could be roughly applicable for other areas with high-volume freight activity and zero-emission technology developments. For each application, we determine a representative vehicle, including powertrain specifications for battery electric and hydrogen variants, as well as multiple representative duty cycles and routes. Charging and refueling needs are assessed for trucks performing each of these duty cycles in terms of hours of charging per day at both ultra-fast and slower charging stations. This is then translated into the number of stations required for a fleet serving a mix of routes.

This analysis is performed for three cases: a low-volume case for an initial deployment of 100 trucks, a medium-volume deployment of 1,000 trucks, and a high-volume, longer-term deployment of 10,000 trucks. In keeping with the experience of light-duty vehicles, we assume that stations will see somewhat higher throughput and benefit from economies of scale in the higher volume cases (Nicholas & Hall, 2018). This section outlines the representative vehicles and duty cycles as well as additional assumptions used for each of these three applications.

VEHICLE AND ROUTE SPECIFICATIONS

Long-haul tractor-trailer. Long-haul, Class 8 tractor-trailers account for the highest share of fuel consumption and greenhouse gas emissions among heavy-duty vehicles, and therefore have great potential for fuel savings and emission reductions through a shift to zero-emissions technologies. However, the travel patterns of these vehicles present challenges; their routes involve multi-day intercity travel rather than frequent returns to a base location. To date, there are no zero-emissions intercity tractor-trailers in operation, although several prototypes have been demonstrated, including the Tesla Semi, Freightliner eCascadia, and Nikola Motors One.

Greater Los Angeles is a hub for freight activity and sees more than 720 million tons of road freight movements annually (Oak Ridge National Laboratory, 2018). Figure 2 displays the profile of road freight movements from the Los Angeles Combined Statistical Area according to the Freight Analysis Framework (FAF4), produced through a partnership between the Bureau of Transportation Statistics and the Federal Highway Administration. Each dot represents a destination region, either a metropolitan statistical area (brown) or a state with its metropolitan areas excluded (blue). Selected markets with high freight traffic from Los Angeles are labeled.

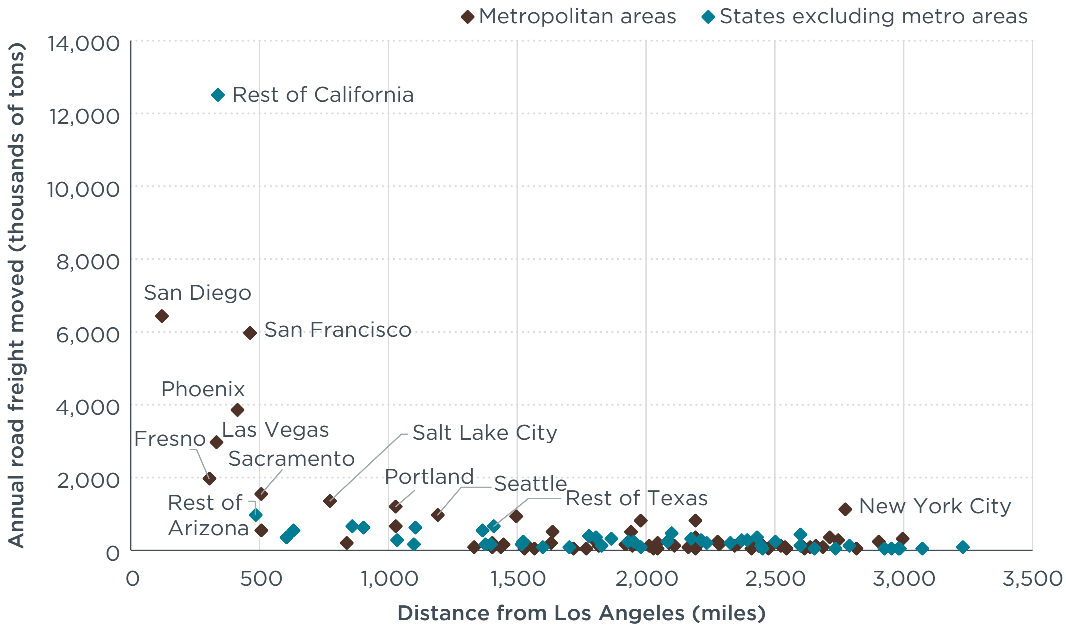


Figure 3. Road freight movement patterns to and from the Los Angeles metropolitan area in 2016 based on the FAF4 database

As shown in the figure, most shipments travel relatively short distances to destinations within California or to nearby cities such as Phoenix and Las Vegas; in fact, 66% of tons, a proxy for truck trips, go to destinations fewer than 1,000 miles away. However, 72% of ton-miles, a rough proxy for truck travel time and energy use, take place on journeys over 1,000 miles. In the near term, it is likely that zero-emission trucks will be concentrated on heavily trafficked, shorter-distance routes (those toward the left of the chart). However, in the long term, zero-emission trucks will need to be capable of much longer journeys.

We assess charging requirements on five routes of different lengths, as outlined in Table 1 below, represented by Los Angeles to San Diego, Las Vegas, Salt Lake City, Seattle, and Chicago. In addition to trip length, the table outlines the assumed distribution of trucks among routes similar to these in the three cases by truck-hours. To provide clear comparisons of how infrastructure needs will evolve with growing scale, we assume the same composition of trips in each case. In reality, initial deployments will likely concentrate on a few short routes where fleets can optimize infrastructure and demand, while later deployments will need to serve a much broader variety of routes.

Table 1. Specifications of selected long-haul routes and assumed breakdown of trips

Trip distance (miles)	100-200	200-500	500-1000	1,000-1,500	2,000 +
Destination from Los Angeles	San Diego	Las Vegas	Salt Lake City	Seattle	Chicago
Road freight (thousand tons, 2016)	7,672	5,893	1,334	930	802
Percentage of fleet driving time	10%	10%	25%	25%	30%

In this analysis, the long-haul tractor-trailer is assumed to be similar in general characteristics to a top-selling long-haul sleeper tractor-trailer in the United States.

Important specifications of the truck used in this analysis are listed in Table 2. Where possible, these values (and the underlying components) stem from the analysis of Moultak et al. (2017) or from announced zero-emission trucks in the same category. Vehicle performance specifications such as efficiency are uncertain given the lack of real-world experience and warrant further analysis. For simplicity, we assume that the vehicle attributes are the same among the three cases.

Table 2. Key specifications for zero-emission long-haul tractor-trailer

	Specification	Value	Notes
	Gross Combined Vehicle Weight Rating (GCVWR)	80,000 lbs	Maximum for Class 8
Battery electric	**Tare weight (truck and trailer)**	33,129 lbs	
	Total baseline battery size	600 kWh	80% available for use
	Electric motor power	550 kW	Equivalent to 700 HP diesel engine
	Energy consumption (without trailer)	1.9 kWh/mile	
	Range (no trailer)	250 miles	
	Range (fully loaded)	190 miles	
	Max fast charging speed	500 kW	
	Depot and overnight charging	50 kW	
Hydrogen fuel cell	**Onboard hydrogen storage**	60 kg	Stored at 70 MPa
	Energy consumption (without trailer)	13 miles/kg	
	Range (no trailer)	800 miles	
	Range (fully loaded)	585 miles	
	Hydrogen fueling rate	3.6 kg/minute	

We assume that these tractor-trailers will carry 75% of their maximum cargo capacity by mass on average, and that they are driven to the maximum extent allowed under U.S. Department of Transportation limits: up to 11 hours of driving or 14 hours of total active time, per day, 235 days per year (Federal Motor Carrier Safety Administration, 2015). We also assume that vehicles will charge at 50 kW overnight, either at a truck stop or at a loading destination. Furthermore, we assume that one-third of loading docks will have charging capability (also at 50 kW), and that the average turnaround time while loading and unloading is 90 minutes. Fast charging (at 500 kW) is used as much as necessary to maximize driving time in a day.

The extra mass of the battery has the potential to reduce the maximum cargo capacity of battery electric tractor-trailers, requiring additional vehicles to haul the same amount of freight. As data emerges from tractor-trailers that move from prototype to more rigorous testing in various conditions, all these assumptions can be further refined.

Drayage truck. Drayage trucks, which carry shipping containers within and around ports, often operate on congested surface streets, and have received intense scrutiny for their air quality and noise impacts in the Los Angeles area. These trucks are frequently identified as an early opportunity for zero-emission truck demonstrations due to their short routes and frequent stops; in fact, zero-emission drayage tractor-trailers are already in use in ports in California and China. Therefore, despite accounting for a relatively small share of greenhouse gas emissions, the electrification of this application can provide substantial benefits. Many trucks in drayage applications are purchased used, leading to lower costs for operators but higher emissions. However, the Port of Los Angeles and Port of Long Beach (which see about 15,000 trucks in drayage applications) have both enacted a Clean Trucks Program requiring the use of newer trucks; as of 2018, any new truck registered for use in the ports must be model year 2014 or newer (Clean Air Action Plan, 2018).

A study from the National Renewable Energy Lab on drayage truck activity around the Ports of Los Angeles and Long Beach provides a useful framework for assessing the infrastructure demands in this application (Prohaska, Konan, Kelly, & Lammert, 2016). The study found that the vast majority of drayage truck trips are short, low-speed trips within or near the port area; however, there are a substantial number of longer trips to railyards and the Inland Empire metropolitan area. The breakdown of truck trips used in the analysis is shown in Table 3. For all cases, our assumed breakdown matches the distribution observed for drayage trucks in the study by Prohaska et al. In reality, we would expect that initial demonstrations of zero-emission drayage trucks would be focused on near-dock applications where infrastructure needs are minimal.

Table 3. Typical drayage truck route profiles and frequency under different cases

Trip type	Port ↔ Near dock	Port ↔ Rail yards	Port ↔ Inland Empire	Port ↔ Beyond Inland Empire	Trip outside of port
Distance (miles)	5	20	50	80	30
Average speed (mph)	20	30	38	48	45
Percentage of truck trips	64%	10%	15%	2%	9%

The truck in the analysis was based on a popular Class 8 day cab, capable of carrying a 40-foot shipping container on a chassis trailer. Key specifications for the truck, as well as the battery electric and hydrogen fuel cell drivetrains, are listed in Table 4. This day cab truck has a smaller battery corresponding to its shorter trip lengths, enabling this battery electric truck to be slightly lighter than the diesel baseline. Again, we assume that the containers carried by these trucks average 75% of their maximum capacity by weight.

Table 4. Key specifications for zero-emission drayage truck

	Specification	Value	Notes
	GCVWR	60,700 lbs	
Battery electric	**Tare weight (truck and trailer)**	20,570 lbs	
	Total baseline battery size	500 kWh	80% available for use
	Electric motor power	500 kW	Equivalent to 670 HP diesel engine
	Energy consumption (without trailer)	1.9 kWh/mile	
	Range (no trailer)	212 miles	
	Range (fully loaded)	175 miles	
	Max fast charging speed	500 kW	
	Depot and port charging	50 kW	
Hydrogen fuel cell	**Onboard hydrogen storage**	50 kg	Stored at 70 MPa
	Energy consumption (without trailer)	13.6 miles/kg	
	Range (no trailer)	680 miles	
	Range (fully loaded)	530 miles	
	Hydrogen fueling rate	3.6 kg/minute	

As with long-haul tractor-trailers, we assume that battery electric drayage trucks have the opportunity to charge overnight, either at the port, a distribution center, or some other location. All trucks have the opportunity to charge during the port turnaround, at 50 kW for 20 of the 40 minutes between trips. Additionally, we assume that 33% of the non-port destinations will be equipped with 50-kW charging stations that can be used for 25 minutes between trips. For hydrogen fuel cell trucks, trucks are refueled when the hydrogen tank reaches 10%.

Delivery trucks. Delivery trucks are a broad, heterogeneous category, composed of medium- and heavy-duty trucks. They play an important role in the last mile of freight, supplying commercial, industrial, and residential addresses. Due to the wide diversity of vehicle types and applications, there is no uniform solution for infrastructure in this application. As an initial exploration, we consider the case of medium-duty Class 6 straight box trucks making regional deliveries and returning to a central depot. Larger, heavy-duty delivery trucks may behave similarly to the drayage trucks described above, and therefore have similar infrastructure needs.

As with other segments, we assume the same distribution of trips for each case. Table 5 outlines the breakdown of trips by distance in these three cases. The table also shows the driving time for each trip; we assume a 30-minute turnaround time at each end of the trip.

Table 5. Breakdown of delivery truck travel by distance

One-way trip distance	15 miles	30 miles	50 miles
Percentage of driving time	35%	35%	30%
Average trip time (minutes)	30	51	67

Although delivery trucks span many sizes, this analysis considers a Class 6 box truck based on a top-selling model in this segment. Key specifications for the delivery truck in this analysis are provided in Table 6 below. The truck is capable of carrying about 10,000 pounds of cargo.

Table 6. Key specifications for zero-emission delivery truck

	Specification	Value	Notes
	GCVWR	25,500 lbs	Class 6
Battery electric	**Tare weight**	10,564 lbs	
	Total baseline battery size	300 kWh	80% available for use
	Electric motor power	350 kW	Equivalent to 500 HP diesel engine
	Energy consumption (empty)	1.4 kWh/mile	Similar to Freightliner eM2
	Range (empty)	172 miles	
	Range (fully loaded)	164 miles	
	Max fast charging speed	350 kW	
	Depot charging	50 kW	
Hydrogen fuel cell	**Onboard hydrogen storage**	25 kg	Stored at 70 MPa
	Energy consumption (empty)	13 miles/kg	
	Range (empty)	330 miles	
	Range (fully loaded)	313 miles	
	Hydrogen fueling rate	3.6 kg/minute	

In each case, we assume that the vehicles perform out-and-back trips (leaving with cargo and returning empty) from a central depot; for battery electric vehicles, 50-kW charging is available at depots. We assume that charging is also available at 33% of the delivery docks outside of the depot. Turnaround time is 30 minutes at both ends, of which 23 minutes can be used for charging. The trucks are assumed to operate for 12 hours per day, representing multiple shifts. Additionally, we assume 50-kW charging is available overnight at depots. Fast charging at 350 kW accounts for the remainder of energy needs.

INFRASTRUCTURE ASSESSMENT

Fast charging needs assessment. We first assume that all trucks will receive a full charge overnight, using 50-kW charging at the home base or at a truck stop, as overnight depot charging is the first and most important component of fleet infrastructure provision (North American Council for Freight Efficiency, 2019). We determine the number of 50-kW charge points needed to provide sufficient overnight charging for the trucks, with additional chargers at a limited number of loading docks. For long-haul and delivery trucks, this requires a dedicated 50-kW overnight charge point for each truck in the low-volume case, with the high-volume case a more efficient ratio of one charge point for every 1.5 trucks, as trucks are not driving the same shift, and many will be able to use charge points in other settings for their overnight needs. For drayage trucks, we assume that most of the charging stations built at the port will also be used for overnight charging. We provide an additional 50-kW charge point for every two drayage trucks for overnight charging, meaning that in total there is about one 50-kW charge point for every 1.5 trucks.

Ultra-fast charging provides the remainder of the energy for the assumed travel requirements. For each vehicle route, we determine both the required number of fast charges and the amount of time needed for these charges, taking into account cases with and without charging available while loading. Charging time is optimized to maximize available driving time during the day. From this, we calculate the total amount of ultra-fast charging time required each day. This is translated into charge points through utilization in terms of average charging hours per day. As demonstrated in the light-duty sector, utilization increases with electric vehicle penetration; this is likely to be true in the heavy-duty sector as well, where routes are more defined and station locations can be carefully optimized (Nicholas & Hall, 2018). For drayage trucks, we use a similar methodology to calculate the number of 50-kW charging stations needed at the port, with utilization increasing over time.

Charging infrastructure costs. At this early stage of development, there is still considerable uncertainty around the specific technologies and costs for heavy-duty electric vehicle charging infrastructure. Currently, light-duty electric vehicle charging standards support up to 350-kW charging, but in practice there are very few charging stations capable of providing more than 140 kW, and few cars will be able to benefit from such power in the near term (Nicholas & Hall, 2018). Some electric buses are capable of charging at 500 kW using proprietary standards. However, industry stakeholders including Tesla and CharIN, developer of the combined charging system (CCS) standard, have stated that charging standards for heavy-duty vehicles should support power levels of at least 1 megawatt (CharIN, 2019; Tesla, 2018). As this technology has not yet been demonstrated, this analysis considers charging speeds of up to 500 kW; higher charging speeds could result in a need for fewer charging stations but at a higher cost per station.

Charging infrastructure costs consist of hardware cost for each individual station as well as the installation and grid connection costs per site. Estimates for these costs are illustrated in Figure 3 in terms of dollars per kilowatt. As seen by the blue and orange lines, the hardware costs for the two station types (50 kW or 350+ kW) do not vary by site size. The per-kW installation costs, however, decline as the total site power increases as grid connection and construction costs can be amortized over more stations. The installation and grid connection costs are based on the findings of a study in Ottawa, Canada (Ribberink, Wilkens, Abdullah, McGrath, & Wojdan, 2017).

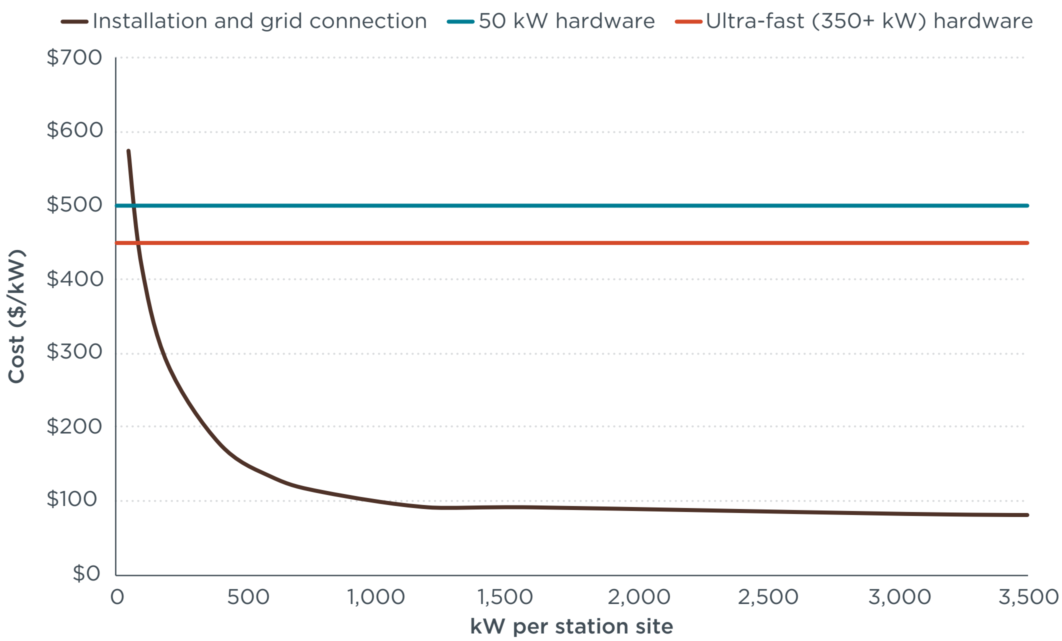


Figure 4. Estimated charging infrastructure hardware and installation costs, shown in dollars per kilowatt, for the low-volume case

This framework suggests that, for a given number of stations, it is generally less costly to build more stations at a few sites, rather than distributing the stations across many sites. For example, if one were to build 16 total 50-kW charging stations, it would cost $5.4 million to build these stations at two sites containing eight stations each, compared with $7.4 million at eight sites with two stations each. For any site with more than two charging stations, the charger hardware will represent the majority of the costs.

Based on experience with other innovations, we assume that the hardware costs of charging stations will decline over this period of analysis as a result of increasing scale and technology improvements. Specifically, we assume a 3% annual cost reduction for 350-kW and 500-kW stations and a 2% annual reduction for 50-kW stations, which are already produced at greater scale for light-duty electric vehicles. This translates to a 14% and 10% cost reduction at medium volume for ultra-fast and 50-kW stations respectively, and a 26% and 18% reduction at high volume. However, we do not reduce the installation costs, as greater scale and improved processes could be offset by the need to install in more challenging locations.

There are a number of tax credits or other incentives for electric vehicle charging stations. The California Electric Vehicle Infrastructure Project (CALeVIP) provides rebates for charging infrastructure in four California regions, with up to $80,000 available for DC fast-charging stations. Furthermore, there are additional innovative programs to generate funding for infrastructure. California's Low Carbon Fuel Standard (LCFS) provides higher credit accrual rates for heavy-duty vehicle charging, providing charging station operators with about $0.16 per kWh of electricity dispensed. This additional revenue could significantly improve the business case for building and operating charging infrastructure for trucks; however, we do not include these credits or incentives in our cost assessment.

Hydrogen fueling needs assessment. To evaluate the number of hydrogen fueling pumps required, we take a similar approach as with electricity. We first determine the energy, and corresponding amount of hydrogen fuel, required to enable our assumed travel patterns. Based on the fill rate, this is translated into average fueling time per truck per day. We then translate this into number of dispensers based on utilization in terms of active hours per day; as with charging stations, utilization increases over time, with large-scale deployment approaching the level seen at diesel fueling stations.

Hydrogen fueling station costs. As of early 2019, there were 39 retail hydrogen fueling stations open in California with more under construction, with at least 20 of these in the Greater Los Angeles area (California Fuel Cell Partnership, 2019). These stations are privately operated and have been supported by funding from the California Energy Commission, automakers, and other public and private sources (California Air Resources Board, 2018). Unlike electric vehicle charging infrastructure, hydrogen standards are similar for light-duty and heavy-duty vehicles, and many stations are already capable of serving both passenger and heavy commercial vehicles. Nonetheless, there has been some dedicated research into hydrogen fueling for heavy-duty vehicles, including the creation of the Heavy-Duty Refueling Station Analysis Model (HDRSAM) by Argonne National Lab, which provides best-available estimates of station capital and operational costs for a variety of configurations and operational profiles (see Argonne National Laboratory, 2017).

Capital costs for hydrogen fueling stations in this analysis are based (with some modifications) on the HDRSAM. Key assumptions on station attributes for the model are described in Table 7. All assumptions not listed in Table 7 use the default values in the model. The station sizes considered range from one to five dispensers, with larger stations becoming more common in the medium and high cases as utilization increases. The operational costs of the stations, which range from $0.43 to $1.07 per kg, are assumed to be integrated into the cost of hydrogen fuel.

Table 7. Station assumptions used to assess station capital costs

	Low volume (100 trucks)	Medium volume (1,000 trucks)	High volume (10,000 trucks)
Hydrogen delivery option	Tube truck delivery		
Production volume of components	Low	Mid	High
Hydrogen dispensing	Cascade, 700 bar		
Hydrogen fueling rate	3.6 kg/minute		
Start-up year	2020	2025	2030

As with electric vehicle charging, numerous programs have emerged to help fund hydrogen fueling stations. The LCFS in California includes provisions to provide credits based on the capacity of hydrogen fueling stations rather than the amount of fuel dispensed; this could make the operation of these stations more lucrative during early market stages. Public-private partnerships among the government, hydrogen manufacturers, and automakers have been crucial for building out the light-duty hydrogen network in California, a model that may also be useful for the heavy-duty market. A deeper analysis of how to fund infrastructure for these applications could be an area for future research.

Station sizing and distribution. Although this research does not attempt to suggest exact locations or sizes for charging or refueling stations, the relative distribution of stations of different sizes will impact infrastructure costs. Particularly in the early market, a less-concentrated network of stations enables greater flexibility in terms of charging, reducing unnecessary driving. Therefore, for each mode, our low-volume case assumes that stations are more widely distributed at smaller sites, while the stations are relatively more clustered with a greater average number of stations per site when considering higher volumes.

The experience with natural gas fueling stations for heavy-duty vehicles provides an example for how hydrogen fueling or ultra-fast charging networks could develop. Compressed natural gas (CNG) stations have many similarities in design and operation to gaseous hydrogen stations in particular but may bear resemblance in network design to ultra-fast charging stations as well. As of May 2019, there are 751 CNG public filling stations available for heavy-duty trucks in the United States with 1,477 dispensers (U.S. Department of Energy, 2019). Thirty-six percent of stations had a single dispenser, 43% had two, 10% had three, 10% had four, and the remaining 1% of stations had five or more dispensers. We assume that, in the high-volume case, hydrogen and ultra-fast charging station sites will be similarly distributed. In the low- and medium-volume cases, station size distributions are further skewed toward stations with one or two dispensers.

For 50-kW charging stations, which are used by battery electric trucks at distribution hubs, loading docks, and at port, we assume a greater concentration, with a large share of stations in the medium- and high-volume cases located at sites with 8 or more chargers. This reflects the likelihood that initial deployments of electric trucks will be concentrated in relatively few fleets using depot charging. However, we also incorporate many smaller sites with one or two chargers, potentially located at loading docks and truck stops, which would face higher per-charger installation and grid connection costs.

WEIGHT AND TIME PENALTY

Battery electric trucks could face additional challenges compared with diesel trucks due to the weight of batteries and the time spent charging. At a battery density of 0.2 kWh/kg, the 600-kWh battery would weigh 3,000 kg. Other components of the battery electric powertrain are estimated to weigh approximately 600 kg. However, the engine, transmission, and fluids in a conventional diesel truck also weigh approximately 3,000 kg (Sharpe, 2019). Therefore, the total loss in cargo capacity is approximately 600 kg, or 3% of the cargo capacity. If a 1-megawatt-hour (MWh) battery was used instead, the resulting loss in cargo capacity would rise to 11%. For delivery trucks, the added mass of the 300-kWh battery pack reduces the maximum cargo capacity of the battery electric truck by about 6% compared with the diesel version. The drayage truck in our scenario, with a 500-kWh battery, weighs slightly less than the diesel equivalent in our scenario. Hydrogen trucks in all applications weigh less than their diesel or battery electric counterparts.

For those segments in which the battery electric truck weighs more than a diesel equivalent, we assume that additional trucks will be needed, a cost which we incorporate into the per-truck analysis. We assume that 50% of trucks would be fully loaded and therefore face this penalty. For example, this means that a fleet operating delivery trucks, with an 11% lower cargo capacity, would need 5.5% more trucks, and therefore face 5.5% higher fleetwide costs. However, it is important to note that policies could reduce or negate this challenge. In California, Assembly Bill 2061, passed in 2018, increases the weight limit for zero-emission trucks by 2,000 pounds over the normal limit for diesel trucks of that class (California Legislative Information, 2018). This allowance negates the weight penalty for all applications in this analysis.

Additionally, battery electric trucks could face a disadvantage due to the amount of charging time required, which could cut into driving time. We assume that if a fleet loses driving time due to charging, additional trucks must be purchased, proportionally increasing fleetwide costs. This cost is calculated separately for each application to account for driving regulations for long-haul tractor-trailers. For drayage and delivery trucks, any time spent fast charging cuts in to active time; for both of these applications, we estimate the average daily fast-charging time at 30 minutes. Faster charging, such as the megawatt standards being developed, could reduce this penalty. Fueling with hydrogen requires a similar amount of time as diesel; therefore, we do not include a time penalty for hydrogen trucks in our analysis.

ANALYSIS

Using the above methodology, we estimate the amount of infrastructure, and the associated outlay, required to power fleets of zero-emission trucks. We do not attempt to site or determine the ideal spatial distribution of infrastructure outside of our assumptions about utilization and station size. Each application is analyzed separately without considering how multiple kinds of vehicles could use the same stations; this strategy could ultimately offer the potential for higher utilization in the near- to medium-term if multiple truck applications typically utilized the same stations. Where there is a time-dependent assumption for cost estimates, we assume that the low-volume case occurs in 2020, the medium-volume case in 2025, and the high-volume case in 2030.

BATTERY ELECTRIC CHARGING INFRASTRUCTURE

The charging infrastructure for electric trucks consists of both ultra-fast charging (350–500 kW) as well as slower (50 kW) charging used overnight and while stopped for loading or unloading. Figure 5 illustrates our estimates for the amount of charging infrastructure needed on a per-vehicle basis (lines and markers, plotted on the right axis), as well as the associated per-vehicle costs for that infrastructure (bars, plotted on the left axis). For both metrics, the results are separated into the 50-kW and ultra-fast infrastructure. The costs also include interest, assuming that these costs are amortized at a 5% interest rate over 80 months, adding 20% to the underlying capital costs.

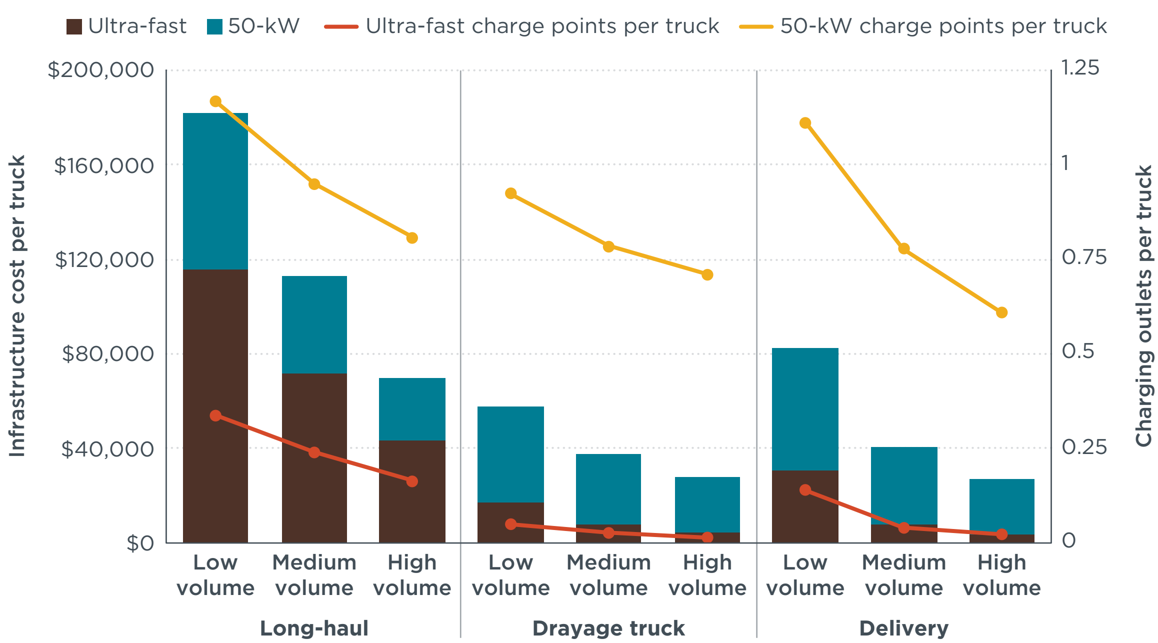


Figure 5. Charging infrastructure and associated capital costs required for battery electric trucks

A number of trends are visible from this chart. First, long-haul tractor-trailers have by far the highest associated infrastructure costs among the three applications, up to $180,000 per truck at low volumes and falling to $69,000 at high volumes. This is followed by delivery trucks ($27,000–$82,000); drayage trucks have the lowest charging infrastructure costs ($28,000–$58,000). This is due to the longer driving distances and heavier vehicle weight, and therefore greater energy consumption, of long-haul tractor-trailers, as well as a lower concentration of charging stations due to the need for a comprehensive, far-reaching network.

Second, there is a general trend of declining cost per truck as truck volumes increase, although this occurs less strongly for drayage and delivery trucks. These cost declines are due to a combination of factors, including falling hardware costs, higher station throughput, improving vehicle efficiency, and more efficient station network design with more chargers per site. This result, however, is sensitive to the truck travel patterns; increasing travel distance and route diversity at greater scale will result in higher total costs (but not necessarily cost per mile). This especially the case for drayage trucks: We estimate that drayage trucks operating on routes of up to 30 miles need no fast charging. Fast charging needs increase significantly as the trucks are deployed onto longer routes to the Inland Empire or beyond, driving up the cost per truck.

Third, ultra-fast charging stations account for a disproportionate share of the costs of charging infrastructure. Specifically, ultra-fast charging accounts for over 60% of infrastructure costs in the long-haul sectors, but 50-kW stations represent about 80% of the chargers by number. For delivery and drayage trucks, where ultra-fast charging plays a smaller role, 50-kW charging represents the majority of costs. For drayage trucks, we estimate that 30% to 45% of these chargers should be located at the port, with the remainder at overnight parking locations or other loading docks. In the case of delivery trucks, 50-kW charging also represents the majority of the cost, and most of this is located at overnight charging depots. For battery electric long-haul and delivery trucks, more than one 50-kW charger is required per truck in the early stages, as we consider chargers at both overnight depots and some loading docks.

In addition to the capital cost of infrastructure, transitioning to battery electric trucks could pose challenges in terms of the time spent charging, especially for long-haul trucking. Figure 6 displays the average time spent charging at ultra-fast chargers (up to 500 kW) per day for drivers on each of the five routes considered (using 2020, low-volume vehicle specifications). The brown bars represent the time required if 50-kW charging is available at the loading depots at each end, while the blue bars represent the time required if no such charging while loading or unloading is available. For all cases, it is assumed that the truck begins the day with a full charge.

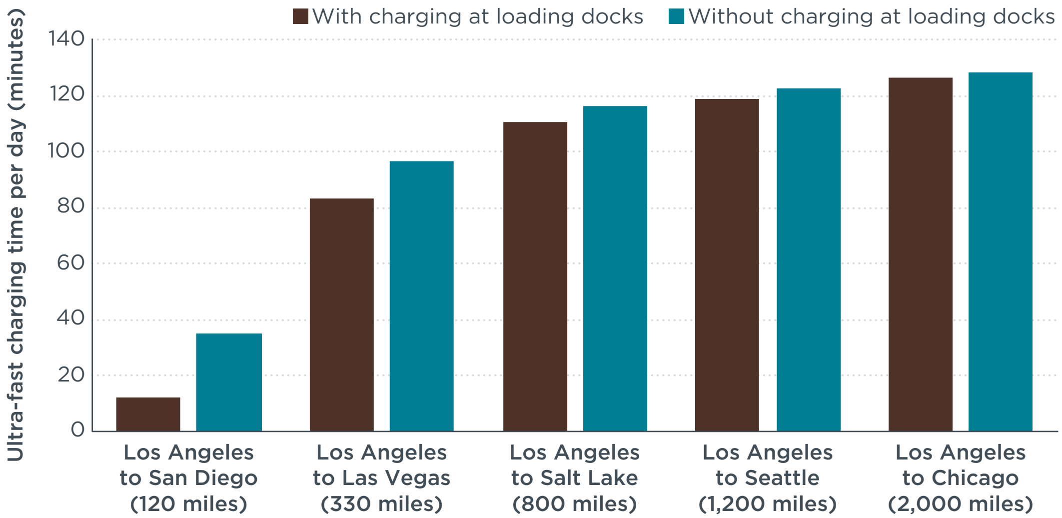


Figure 6. Daily ultra-fast charging time required on various routes from Los Angeles

As expected, the average daily time spent fast charging increases with the route length, up to 2 hours for a driver on the route to Chicago without charging available at depots. Although this is a significant amount of time, and much higher than is required to refuel a diesel- or hydrogen-powered vehicle, it does not significantly affect total daily driving time within legal limits. However, on the Los Angeles to Las Vegas route (and routes of similar length) where both charging and loading time are significant, drivers could lose over an hour of eligible driving time per day due to the charging requirements, reducing driving time by up to 15%. The reduced need for fast charging on short routes in the 100- to 200-mile range indicates that these routes could be an ideal test case for early deployments of battery electric trucks.

HYDROGEN FUELING STATIONS

Our estimates for the number of hydrogen fueling stations and the associated capital costs are presented in Figure 7. The brown vertical bars represent the infrastructure costs on a per-truck basis including interest costs. The lines represent the number of station locations (blue) and the number of dispensers (yellow) per truck; for example, in the medium-volume long-haul case, there is about one dispenser for every 25 trucks and one station site for every 40 trucks. The ratio between these two values indicates the number of pumps per station. As with natural gas fueling, the average number of pumps per site increases somewhat from about 1.5 in the low-volume case to 2 in the high-volume case.

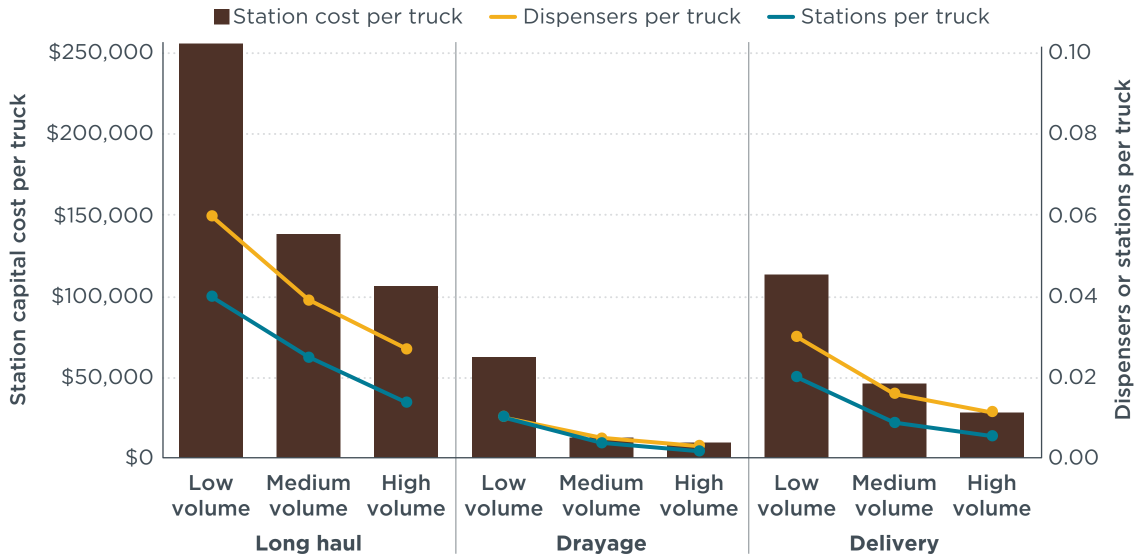


Figure 7. Hydrogen fueling infrastructure and associated capital costs for hydrogen fuel cell trucks

This figure offers insights about the deployment of fueling infrastructure for fuel cell heavy-duty trucks. First, long-haul tractor-trailers demand the most infrastructure investment by a large margin, followed by delivery trucks and drayage trucks. This is the same pattern as for electric charging infrastructure. Second, costs per truck decline significantly as scale increases, with large cost declines from the first 100 trucks to the first 1,000 trucks and more moderate declines afterward. This trend is consistent across each application. The cost reductions are attributable to the higher utilization of stations, as well as the increasing number of pumps per station and the falling component costs with increasing scale.

This analysis suggests that infrastructure for the hydrogen pathway is generally costlier than battery electric; however, the difference is far from uniform. For drayage trucks, battery charging infrastructure is more than twice as costly as hydrogen fueling infrastructure for the medium- and high-volume cases. Hydrogen faces the largest cost penalty in the near-term, when stations see low utilization. We note that there is significant uncertainty regarding infrastructure for all kinds of zero-emission heavy-duty vehicles. For example, grid connection costs for extremely high-power charging stations (upwards of 4 MW at a site) are not well-known and could result in higher costs.

IMPLICATIONS FOR COST OF OWNERSHIP

This analysis indicates that the infrastructure for zero-emission heavy-duty trucks will require significant funding, particularly for long-haul tractor-trailers and in early phases of deployment. However, it is important to place these expenses in the context of the total cost of ownership (TCO) of these powertrain options. This section outlines how infrastructure contributes to the TCO for each application, adding these infrastructure costs to vehicle purchase, fuel or energy, and maintenance expenses. Because we expect higher numbers of each truck to be deployed as technology improves, we have assigned cost estimates accordingly: The low-volume (100 trucks) case is assigned 2020 cost estimates, the medium-volume (1,000 trucks) case is estimated at 2025 costs, and the high-volume (10,000 trucks) case uses 2030 costs. We assume that the trucks deployed in each case perform similar duty cycles over their 10-year initial lifetime, and that annual miles decline 2% each year.

These results are applied to the TCO analysis framework in Moultak et al., tailored for the three applications. The previously described battery electric and hydrogen fuel cell trucks (using either methane-derived or renewable hydrogen) are compared with conventional diesel trucks. Selected component costs such as batteries and electric motors have been updated based on new research (see Lutsey & Nicholas, 2019). Details on the assumptions used for cost projections can be found in the Appendix. Diesel prices are based on the U.S. Energy Information Administration's reference case estimates for the Pacific region, with updated California tax rates (Energy Information Administration, 2019). Electricity prices are based on Southern California Edison's industrial customer rates, with 2% projected annual increase; ultra-fast charging is assumed to cost 57% more than overnight 50-kW charging as a result of demand charges. We derive maintenance costs from the AFLEET model by Argonne National Laboratory (see Burnham, 2018). Vehicle and infrastructure capital costs are amortized over an 80-month period at a 5% interest rate, and a 4% discount rate is used for future fuel and maintenance expenses.

Long-haul tractor trailer. This is the largest, most expensive vehicle type, and also consumes the most fuel due to the long journeys. Figure 8 illustrates how battery electric and hydrogen fuel cell tractor-trailers compare with conventional diesel in terms of TCO over a 10-year lifetime, including infrastructure costs. The bars represent the four primary cost drivers: vehicle capital cost, maintenance, fuel or energy, and the infrastructure per vehicle. The vehicle cost includes the tractor and three trailers, which are identical for each powertrain. In most cases, fuel or energy costs make up the largest portion of TCO. The green bars represent the cost of additional tractor-trailers due to the "weight penalty" from batteries, which means that fleets would have to be approximately 1% larger to carry the same cargo, although recent regulations negate this issue for zero-emission trucks in California. The tan bars represent an added "time penalty" representing increased fleet size required to make up for lost driving time spent charging. For 2020, this is estimated to be about a 3% penalty across the fleet (with some routes being higher), with later years seeing lower penalties due to greater efficiency. Hydrogen tractor-trailers do not face weight or time penalties as their weight and refueling times are comparable to diesel.

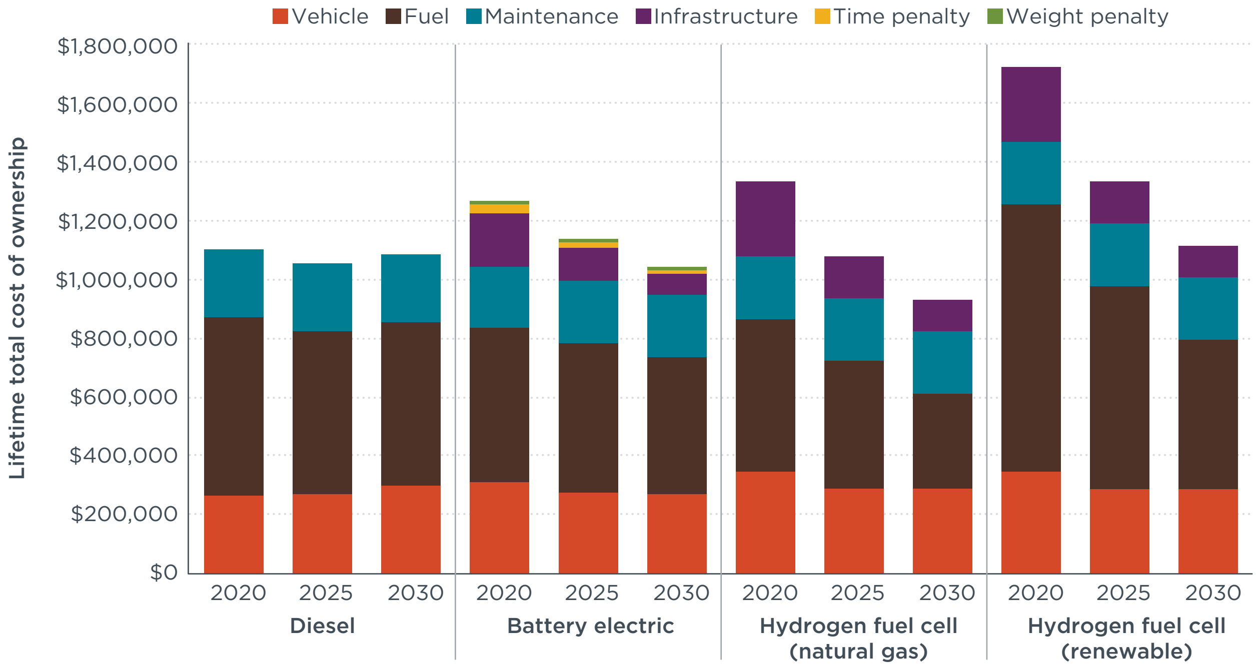


Figure 8. Total cost of ownership for diesel, electric, and hydrogen fuel cell long-haul tractor-trailers

This figure indicates that infrastructure costs can represent a significant increase to TCO for zero-emission tractor-trailer trucks, generally representing between 10% and 20% of the TCO but decreasing over time. In the 2025 case, charging infrastructure adds over $110,000 per battery electric long-haul tractor-trailer, amounting to 10% of the lifetime operating cost, which includes vehicle, fuel, maintenance, and infrastructure. At greater scale in 2030, charging infrastructure costs add about $70,000 per battery electric long-haul tractor, amounting to 7% of the lifetime operating cost. Hydrogen infrastructure for the fuel cell tractors is estimated at $105,000 per tractor by 2030, or 9% of the lifetime operating cost.

In terms of vehicle cost in Figure 8, a battery electric tractor-trailer costs $49,000 more upfront than a comparable diesel tractor-trailer in 2020. Diesels remain the least expensive through approximately 2026, when battery electric tractor-trailers become less expensive. Hydrogen fuel cell tractor-trailers are projected to be less expensive than diesel by 2028. By 2030, battery electric tractor-trailers are expected to be $26,000 less expensive than diesel in purchase price, and fuel cell tractor-trailers will cost approximately $13,000 less than diesel.

The figure illustrates that zero-emission tractor-trailers can offer lower costs than traditional diesel equivalents. Battery electric tractor-trailers meet TCO parity with diesel tractor-trailers by 2030. Fuel cell tractor-trailers using hydrogen derived from natural gas through steam methane reformation (SMR) reach cost parity with diesel counterparts between 2025 and 2028, while operating those tractor-trailers with renewable hydrogen suggests a 3% TCO penalty versus diesel even in 2030. Nonetheless, fuel cell tractor-trailers could remain compelling for their operational benefits relative to battery electric options, considering their short refueling times and lighter tractors.

The lifetime ownership cost of each zero-emission option is expected to steadily decline from 2020 to 2030 as a result of falling vehicle costs and improved efficiency, as well as less expensive hydrogen fuel for fuel cell vehicles. On the other hand, increasing fuel and vehicle costs are projected to outweigh savings from efficiency improvements for diesel tractor-trailers in the 2025 to 2030 time frame, resulting in a higher lifetime cost for a truck purchased in 2030 than in 2025. This suggests that the TCO and upfront price savings for zero-emission tractor-trailer options will only accelerate after 2030.

Acknowledging the many assumptions required in modeling the costs associated with these technologies, a simple sensitivity analysis was performed on key assumptions around battery electric long-haul tractor-trailers. We find that TCO is relatively insensitive to the vehicle's battery size; increasing or decreasing battery capacity by 50% increases TCO by only 1% in the 2030 time frame. For a larger battery, higher vehicle cost is offset by reduced infrastructure and time penalty costs. Total ownership costs are sensitive to vehicle efficiency; a 15% increase or decrease in energy consumption per mile results in a 9% increase or decrease respectively in lifetime cost. Further details on the sensitivity analysis are reported in the Appendix. We report numbers for our 2030 high-volume case, but effects in the 2025 medium-volume case are very similar.

Drayage trucks. Drayage trucks typically see much lower mileage than long-haul tractor-trailers, significantly altering the composition of their lifetime costs and providing different prospects for zero-emission variants. Figure 9 provides an overview of the TCO for each technology option for new drayage trucks. The color scheme and layout are the same as in Figure 8 above. Electric drayage trucks also face a small "time penalty," assumed to equal the percentage of the day dedicated to fast charging (compared with an assumed 5 minutes spent fueling); this increases fleetwide cost by less than 1% in our analysis. Vehicle costs represent a much higher share of the TCO for drayage trucks than for other applications. As with the long-haul sector, vehicle costs include the tractor as well as three container trailers.

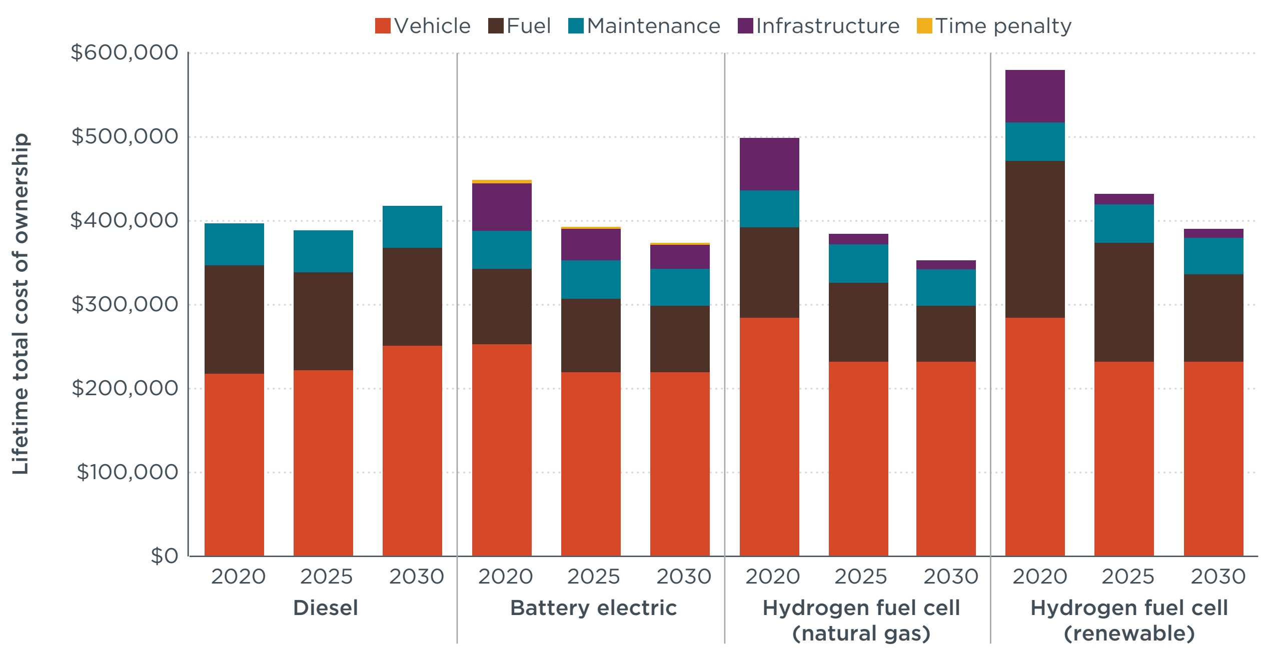


Figure 9. Total cost of ownership for diesel, electric, and hydrogen fuel cell Class 8 drayage trucks

For the drayage truck application, infrastructure needs for battery electric and hydrogen trucks alike are far less complex and represent only a small share of TCO. In the 2025 case, charging infrastructure adds $38,000 per battery electric drayage tractor, amounting to 10% of the lifetime operating cost. At greater scale in 2030, charging infrastructure costs add approximately $28,000 per battery electric drayage truck, amounting to 7% of the lifetime operating cost. Hydrogen infrastructure for the fuel cell drayage trucks is estimated at $10,000 per truck by 2030, or 3% of the lifetime operating cost.

The lower annual mileage in this application reduces the potential savings in fuel and maintenance, as compared with the long-haul tractor-trailer case. We estimate that battery electric trucks in the 2020 case are costlier over their lifetime than their diesel counterparts by $69,000, with an upfront cost premium of $35,000. By 2030, however, the TCO of a battery electric truck is 11% lower than diesel, and the truck purchase price is $31,000 less. Although we estimate that hydrogen trucks are costlier in the near term, they too become less expensive than diesel from a TCO standpoint: in about 2025 for hydrogen from SMR and around 2028 for hydrogen from renewable sources. We also anticipate that the upfront costs of both battery electric and fuel cell trucks will fall below that of diesel trucks in this application before 2030.

Many trucks used in drayage applications are purchased used rather than new. Even within the model year constraints imposed by the San Pedro Bay Ports, a 5-year-old truck can cost up to two-thirds less than a new truck with similar specifications. This in turn would reduce the 10-year TCO for the diesel truck by about 45% (although fuel and maintenance expenses could increase somewhat), eliminating any TCO benefit for a new battery electric or fuel cell truck even in 2030. This reveals a complexity for converting drayage trucks to zero emissions, despite the other promising benefits of zero-emission trucks in this application. Further tightening the Clean Trucks Programs at the ports could help to reduce this disparity in the future; in the long run, a second-hand market for zero-emission trucks could also emerge to serve this application.

Delivery trucks. Delivery trucks lie between long-haul tractor-trailers and drayage trucks in terms of travel distances and infrastructure requirements; these smaller trucks also have lower vehicle costs and higher efficiency than the Class 8 trucks in previous examples. Figure 10 below displays a similar TCO calculation, including infrastructure, for these trucks under the cases described above. Once again, the colored bars represent the cost of each component of ownership costs over the lifetime of the truck in 2018 dollars. As with long-haul tractor-trailers, the green bars illustrate the penalty that fleets would face due to the reduced cargo capacity of battery electric trucks assuming that 50% of trips are carrying the maximum cargo weight.

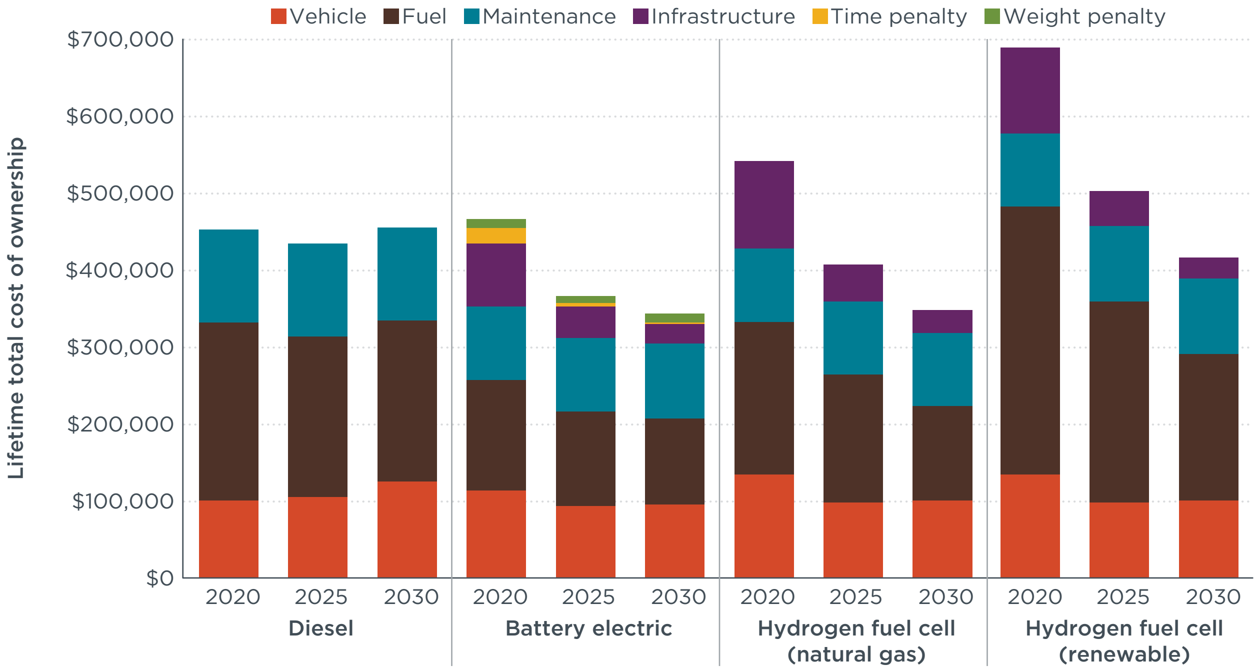


Figure 10. Total cost of ownership for diesel, electric, and hydrogen fuel cell Class 6 delivery trucks

In this analysis, delivery trucks present the most favorable cost picture for zero-emission technologies. Battery electric trucks, even when including the cost of overnight and fast-charging stations, cost approximately 3% ($14,000) more to operate over their lifetime in 2020; the upfront purchase price of the vehicle is about $12,000 more. By 2030, the vehicle upfront cost is $30,000 lower, while the lifetime savings are over $100,000. Hydrogen fuel cell trucks are also economically attractive with higher volumes: Fuel cell trucks using natural gas-derived hydrogen reach TCO parity with diesel in the early 2020s, and even renewably derived hydrogen reaches TCO parity with diesel in 2028 and upfront vehicle cost parity in 2024.

In terms of the infrastructure costs for the delivery trucks, charging infrastructure adds over $40,000 per battery electric in the 2025 case, amounting to 13% of the lifetime operating cost. At greater scale in 2030, charging infrastructure costs add approximately $27,000 per battery electric delivery truck, amounting to 9% of the lifetime operating cost. Hydrogen infrastructure for the fuel cell delivery applications are estimated at $29,000 per truck by 2030, or 7% to 8% of the lifetime operating cost.

Summary of infrastructure and ownership costs. Table 8 summarizes the principal quantitative findings of this analysis. The table illustrates the amount of infrastructure, associated infrastructure capital cost (on a total and per-vehicle basis), and TCO comparison (as percentage difference from diesel) for each of the applications and cases analyzed. The infrastructure counts shown are for the number of electric chargers at 50 kW and higher or the number of hydrogen fueling dispensers; the number of charging and fueling sites will be lower. The TCO incorporates all infrastructure capital costs and associated financing, for which the truck operators may not be fully responsible. For hydrogen vehicles, the ownership cost assumes using renewable hydrogen; using methane-derived hydrogen results in significantly lower costs, but much higher CO_2 emissions.

Table 8. Charging and hydrogen infrastructure for increasing truck volume in three applications

Technology	Application	Case[a]	Number of trucks	Charging outlets needed	Infrastructure cost (million)	Infrastructure cost per truck (thousand)	Vehicle ownership cost difference from diesel
Electric	**Delivery** (Class 6, 9.75-13 tons)	Low volume	100	130	$8	$82	0% to +5%
		Medium volume	1,000	820	$40	$40	-15% to -10%
		High volume	10,000	6,300	$270	$27	-25% to -20%
	Drayage (Class 7-8, 13+ tons)	Low volume	100	100	$6	$58	+10% to +25%
		Medium volume	1,000	810	$38	$38	0% to +5%
		High volume	10,000	7,300	$280	$28	-15% to -10%
	Long haul (Class 8, 16.5+ tons)	Low volume	100	150	$18	$182	+13% to +18%
		Medium volume	1,000	1,200	$113	$113	+5% to +10%
		High volume	10,000	9,700	$700	$70	-5% to 0%
Hydrogen fuel cell	**Delivery** (Class 6, 9.75-13 tons)	Low volume	100	3	$11	$113	+50% to +55%
		Medium volume	1,000	16	$46	$46	+15% to +20%
		High volume	10,000	112	$290	$29	-10% to -5%
	Drayage (Class 7-8, 13+ tons)	Low volume	100	1	$6	$62	+40% to +50%
		Medium volume	1,000	5	$13	$13	+10% to +15%
		High volume	10,000	33	$100	$10	-10% to -5%
	Long haul (Class 8, 16.5+ tons)	Low volume	100	6	$26	$255	+50% to +60%
		Medium volume	1,000	39	$139	$139	+20% to +30%
		High volume	10,000	271	$1,060	$106	0% to +5%

[a] Low volume applies to 2020; medium volume to 2025; high volume to 2030

CONCLUSIONS

This paper builds on previous analyses of the costs and feasibility of zero-emission heavy-duty freight trucks by assessing the infrastructure needs and related costs for the transition to zero-emission trucks operating in three applications in the Los Angeles, California, area. Specifically, we estimate the number and cost of charging stations for battery electric trucks, and of hydrogen refueling stations for fuel cell trucks, operating in long-haul tractor-trailer, port drayage, and local delivery applications. From this analysis, we draw the following conclusions.

Falling technology costs are making zero-emission trucks increasingly cost-competitive. Cost declines in batteries and electric motors in particular make battery electric trucks less expensive than diesel trucks in purchase price between 2025 and 2030. Obstacles such as charging time and reduced cargo capacity could add complications and costs for electric fleets beginning the transition. Fuel cell trucks could also become less expensive in upfront cost before 2030. As demonstration projects scale up and learning from other sectors continues, cost declines in hydrogen fueling stations and ultra-fast charging infrastructure will be important in transitioning the long-range applications that account for the greatest share of truck fuel use and emissions.

Infrastructure costs are significant, but do not fundamentally impede the viability of zero-emission trucks. Whether constructed by fleets, third parties, or public agencies, charging infrastructure and hydrogen refueling infrastructure pose significant costs for zero-emission trucks, particularly in the early stages of deployment. The per-tractor charging infrastructure costs for electric long-haul tractor-trailers range from $113,000 at lower volumes in the 2025 time frame, to $70,000 at higher volumes in the 2030 time frame. For long-haul fuel cell tractor-trailers, hydrogen infrastructure costs could be as much as $140,000 at low volumes, declining to around $105,000 at larger scale. As scale increases, infrastructure represents a decreasing portion of total operating expenses. In 2025, at the scale of about 1,000 trucks, infrastructure represents about 10% to 14% of the total cost of ownership, whereas this share drops to 7% to 10% in the 2030 time frame with tens of thousands of trucks.

When including these infrastructure costs in overall operating costs, both battery electric and hydrogen fuel cell long-haul tractor-trailers have the potential to be less expensive than diesel trucks in the 2030 time frame at a scale of about 10,000 trucks. Delivery trucks offer even more promising reductions, with total cost of ownership for battery electric trucks falling below that of diesel trucks in the early 2020s and even renewable-powered hydrogen trucks reaching lifetime cost parity before 2030.

If infrastructure costs are excluded from TCO calculations, fleets would see lifetime ownership benefits from zero-emission long-haul tractor-trailers in the early 2020s, five to 10 years earlier than if the fleets cover the infrastructure costs directly. As a result, sharing the infrastructure costs with some combination of governments, utilities, and other providers could enable much faster adoption of zero-emission trucks. Innovative programs such as California's Low Carbon Fuel Standard could help to provide funding needed to build infrastructure in the early stages of the market. Drayage trucks require much less costly infrastructure, making them an ideal case for early demonstration projects, but face additional market barriers, as the fleets are typically comprised of older, less expensive trucks.

Initial infrastructure buildouts will be costly without careful planning and coordination. Early deployments of zero-emission trucks, at the scale of 100 vehicles, would mean high infrastructure expenditures with low utilization to build a network capable of supporting vehicles' duty cycles. It is therefore especially important to plan these initial deployments to specific fleet operation routes and applications where duty cycles are dependable and less onerous, such that a relatively small number of stations can serve all of the recharging or refueling needs. For battery electric trucks, providing charging overnight and at loading and unloading locations can reduce ultra-fast charging needs and total costs. Additionally, coordination among different fleets and operators could help to distribute the high initial costs by enabling multiple types of vehicles to share the same infrastructure. Government-led programs and public-private partnerships could help to coordinate investments. As the market grows, infrastructure should see higher utilization and expansions can be concentrated at a smaller number of sites, eventually leading to a business case for construction and operation of charging or refueling networks.

Policy will be needed to spur this transition to zero-emission trucks. This analysis was focused on the shift from hundreds to tens of thousands of zero-emission trucks in three freight applications. To move through these steps, new zero-emission truck models need to be developed and improved, with continued investments to bring greater volume and lower costs. With policy and government support, such as the zero-emission truck regulation that California is considering, the scale of the changes assessed in this report could happen within 10 years, but without such policy it could take decades (California Air Resources Board, 2019). Regulations, coupled with financial incentives and public funding or sharing of infrastructure costs, could enable a more rapid shift toward zero-emission vehicles. Additionally, other agencies such as ports and electric utilities can play crucial roles in building infrastructure and overcoming the many barriers that zero-emission trucks face.

This analysis offers both encouraging findings for the feasibility of introducing zero-emission trucks as well as an indication of the scale of investment and planning that will be needed to build the infrastructure associated with this transition. The findings also indicate numerous opportunities for further research. Because vehicle fleet operations and duty cycles vary widely among and within countries, similar analyses could estimate how charging needs and cost dynamics might differ elsewhere. Quantifying the impact of ultra-fast charging on the electric distribution grid, as well as evaluating opportunities for smart charging in these applications, could help to guide utility planning and minimize grid upgrade costs. The topic of coordination and cross-use of infrastructure for different types of fleets, including usage of infrastructure by both light- and heavy-duty vehicles, requires additional study. A third type of zero-emission trucks, e-roads powered by catenary lines in-road dynamic charging, could also be considered for applications with concentrated traffic and high power use. Despite substantial costs and uncertainties, it is evident that zero-emission trucks, and the many air quality and climate benefits they will bring, are on the way.

REFERENCES

Argonne National Laboratory (2017). *Heavy-duty refueling station analysis model (HDRSAM).* Retrieved from U.S. Department of Energy Office of Science website: https://hdsam.es.anl.gov/index.php?content=hdrsam

Burnham, A. (2018). *User guide for AFLEET Tool 2018*. Retrieved from Argonne National Laboratory, U.S. Department of Energy, website: https://greet.es.anl.gov/files/afleet-tool-2018-user-guide

California Air Resources Board (2018). *2018 Annual evaluation of fuel cell electric vehicle deployment & hydrogen fuel station network development.* Retrieved from https://ww2.arb.ca.gov/resources/documents/2018-annual-hydrogen-evaluation

California Air Resources Board (2019). *Advanced clean trucks (ACT) fact sheet.* Retrieved from https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-trucks-act-fact-sheet

California Fuel Cell Partnership (2019). *FCEV Sales, FCEB, & hydrogen station data*. Retrieved from https://cafcp.org/by_the_numbers

California Legislative Information (2018). AB-2061 Near-zero-emission and zero-emission vehicles. Retrieved from https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB2061

CharIn e.V. (2019). *CharIN high power commercial vehicle charging task force aggregated requirements.* Retrieved from https://www.charinev.org/fileadmin/HPCCV/High_Power_Commercial_Vehicle_Charging_Requirements_v2.0.pdf

Clean Air Action Plan (2018). Clean Trucks Program: Overview of new registration requirements and FAQ. *Port of Long Beach and Port of Los Angeles.* Retrieved from http://www.cleanairactionplan.org/documents/clean-trucks-program-tariff-change-fact-sheet-sept-2018.pdf

Daimler North America (2018, June 6). *Daimler Trucks North America unveils two Freightliner electric vehicle models and Freightliner Electric Innovation Fleet* [Press release]. Retrieved from https://www.prnewswire.com/news-releases/daimler-trucks-north-america-unveils-two-freightliner-electric-vehicle-models-and-freightliner-electric-innovation-fleet-300661205.html

Earl, T., Mathieu, L., Cornelis, S., Kenny, S., Ambel, C.C., & Nix, J. (2018). *Analysis of long haul battery electric trucks in EU.* Retrieved from the European Federation for Transport and Environment website: https://www.transportenvironment.org/publications/analysis-long-haul-battery-electric-trucks-eu

Energy Information Administration (2019). Annual Energy Outlook 2019. Retrieved from https://www.eia.gov/outlooks/aeo/index.php

Federal Motor Carrier Safety Administration (2015). *Interstate truck driver's guide to hours of service.* Retrieved from the U.S. Department of Transportation website: https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Drivers%20Guide%20to%20HOS%202015_508.pdf

International Energy Agency (2017). *Energy technology perspectives 2017*. Retrieved from www.iea.org/etp/

Kühnel, S., Hacker, F., & Görz, W. (2018). *Oberleitungs-Lkw im Kontext weiterer Antriebs- und Energieversorgungsoptionen für den Straßengüterfernverkehr [Catenary freight trucks in the context of further powertrain and energy supply options for long-distance road freight transport].* Retrieved from Öko-Institut e.V website: https://www.oeko.de/publikationen/p-details/oberleitungs-lkw-im-kontext-weiterer-antriebs-und-energieversorgungsoptionen-fuer-den-strassengueterfe/

Lutsey, N., & Nicholas, M. (2019). *Update on electric vehicle costs in the U.S. through 2030* [Working paper]. Retrieved from the International Council on Clean Transportation website: https://www.theicct.org/publications/update-US-2030-electric-vehicle-cost

Moultak, M., Lutsey, N., & Hall, D. (2017). *Transitioning to zero-emission heavy-duty freight vehicles* [White paper]. Retrieved from the International Council on Clean Transportation website: https://www.theicct.org/publications/transitioning-zero-emission-heavy-duty-freight-vehicles

Nicholas, M., & Hall, D. (2018). *Lessons learned on early electric vehicle fast-charging deployments* [White paper]. Retrieved from the International Council on Clean Transportation website: https://theicct.org/publications/fast-charging-lessons-learned

North American Council for Freight Efficiency (2019). *Amping up: Charging infrastructure for electric trucks.* Retrieved from https://nacfe.org/future-technology/amping-up-charging-infrastructure-for-electric-trucks/

Oak Ridge National Laboratory (2018). Freight Analysis Framework Version 4 [Data set]. Retrieved from the Center for Transportation Analysis website: https://faf.ornl.gov/fafweb/Default.aspx

Prohaska, R., Konan, A., Kelly, K., & Lammert, M. (2016). *Heavy-duty vehicle port drayage drive cycle characterization and development.* Retrieved from the National Renewable Energy Lab website: https://www.nrel.gov/docs/fy16osti/66649.pdf

Ribberink, H., Wilkens, L., Abdullah, R., McGrath, M., & Wojdan, M. (2017, October). *Impact of clusters of DC fast charging stations on the electricity distribution grid in Ottawa, Canada.* Presented at the 30th International Electric Vehicle Symposium and Exhibition, Stuttgart, Germany.

Sharpe, B. (2019). *Zero-emission tractor trailers in Canada* [Working paper]. Retrieved from the International Council on Clean Transportation website: https://www.theicct.org/publications/zero-emission-tractor-trailers-canada

Tesla (2018). *Heavy-duty electric trucks high power charging* [Fact sheet].

Tryggestad, C., Sharma, N., van de Staaij, J., & Keizer, A. (2017). *New reality: Electric trucks and their implications on energy demand*. Retrieved from McKinsey Energy Insights website: https://www.mckinseyenergyinsights.com/insights/new-reality-electric-trucks-and-their-implications-on-energy-demand

U.S. Department of Energy (2019). *Natural gas fueling station locations* [Data set]. Retrieved from the Alternative Fuels Data Center: https://afdc.energy.gov/fuels/natural_gas_locations.html#/analyze?fuel=CNG

Wang, J. M., Jeong, C.-H., Hilker, N., Shairsingh, K.K., Healy, R.M., Sofowote, U., …Evans, G.J. (2018). Near-road air pollutant measurements: Accounting for inter-site variability using emissions factors. *Environmental Science and Technology, 52*(16), 9495-9504. doi: 10.1021/acs.est.8b01914

APPENDIX

DETAILS ON ANNOUNCED AND PRODUCTION ZERO-EMISSION TRUCKS

Table A1. Announced or in-production battery electric medium- and heavy-duty trucks

Make	Model	Range (miles)	Battery capacity (kWh)	Vehicle class	First demonstration	Start of regular production
Eforce	EF18 SZM	310	630	8 (Tractor-trailer)	2016	2017
Eforce	EV26	310	630	8 (Straight truck)	2016	2017
Thor	ET-One	300	800	8 (Tractor-trailer)		2019
Volvo	FL Electric	186	300	7		2019
BYD	Day Cab	167	435	8 (Tractor-trailer)		2018
emoss	EMS 18 Series	155	240	8 (Straight truck)	2017	2018
emoss	EMS 16 Series	130	200	8	2015	2018
emoss	EMS 12 Series	124	200	7	2013	2018
BYD	Class 6 Truck	124	221	6		2018
Cummins	AEOS	100	140	7	2018	2019
emoss	EMS 10 Series	93	120	6	2014	2018
Mitsubishi FUSO	eCanter	62	83	4	2017	2019
Tevva	eTruck	93	75	4-6		2018
Tesla	Semi	550	1000	8 (Tractor-trailer)	2018	2020
Nikola	Two	400	1000	8 (Tractor-trailer)	2019	
Freightliner	eCascadia	250	550	8 (Tractor-trailer)	2018	2021
Lion	Lion8	250	480	8	2018	2020
Freightliner	eM2 106	230	325	5	2018	2021
Mercedes-Benz	eActros	125	240	7-8 (Straight truck)	2018	2021
MAN	eTGM	124	150	7-8 (Straight truck)	2018	
Volvo	VNR	124	300	8	2019	2020
Volkswagen	e-Delivery	124	200	4	2018	2020
Peterbilt	e220	100	148	6	2019	
Xos	MDV	50	60	6	2018	2020
Eforce	EF18 SZM	310	630	8 (Tractor-trailer)	2016	2017
Eforce	EV26	310	630	8 (Straight truck)	2016	2017
Thor	ET-One	300	800	8 (Tractor-trailer)		2019
Volvo	FL Electric	186	300	7		2019
Volkswagen	e-Delivery	124	200	4	2018	2020
Peterbilt	e220	100	148	6	2019	
Xos	MDV	50	60	6	2018	2020

Table A2. Announced or in-production hydrogen fuel cell medium- and heavy-duty trucks

Make	Model	Range (miles)	Vehicle class	First demonstration	Start of regular production
Nikola	One	1000	8 (Tractor-trailer)		2022
Toyota	Beta	300	8 (Tractor-trailer)	2018	
Kenworth	T680	300	8 (Tractor-trailer)	2019	
Hyundai	XCient	238	8 (Straight truck)		2019
Dongfeng	Special Vehicle	205	4	2017	

VEHICLE AND INFRASTRUCTURE SPECIFICATIONS

Table A3. Additional technical assumptions used in infrastructure and TCO analysis

Value	Long-haul tractor-trailers			Drayage truck			Delivery truck		
	2020	2025	2030	2020	2025	2030	2020	2025	2030
Diesel price ($/gallon)	$3.75	$4.07	$4.71	$3.75	$4.07	$4.71	$3.75	$4.07	$4.71
Electricity price ($/kWh)	$0.14	$0.16	$0.17	$0.14	$0.16	$0.17	$0.14	$0.16	$0.17
Ultra-fast charging price ($/kWh)	$0.23	$0.24	$0.26	$0.23	$0.24	$0.26	$0.23	$0.24	$0.26
Hydrogen from natural gas ($/kg)	$5.12	$4.64	$4.17	$5.12	$4.64	$4.17	$5.12	$4.64	$4.17
Hydrogen from renewable sources ($/kg)	$9.26	$8.07	$6.88	$9.26	$8.07	$6.88	$9.26	$8.07	$6.88
Diesel maintenance cost ($/km)	$0.118	$0.118	$0.118	$0.118	$0.118	$0.118	$0.127	$0.127	$0.127
Battery/fuel cell maintenance cost ($/km)	$0.107	$0.107	$0.107	$0.107	$0.107	$0.107	$0.101	$0.101	$0.101
Battery electric annual efficiency improvement	2.1%								
Hydrogen fuel cell annual efficiency improvement	2.5%								
Diesel annual efficiency improvement	4%								
Annual vehicle miles traveled	140,653	141,859	142,435	30,193	30,193	30,193	68,647	68,647	68,647
Electric drive power (kW)	700			600			450		
Battery density (kWh/kg)	0.2								
Battery pack cost ($/kWh)	$152	$106	$74	$152	$106	$74	$152	$106	$74
50-kW charging station hardware cost	$25,000	$22,598	$20,427	$25,000	$22,598	$20,427	$25,000	$22,598	$20,427
Ultra-fast charging station hardware cost	$225,000	$193,215	$165,920	$225,000	$193,215	$165,920	$ 140,000	$ 120,223	$165,920
Single-dispenser H_2 station cost*	$4,971,061	$3,351,993	$2,882,217	$4,971,061	$2,149,144	$2,447,139	$3,239,012	$2,203,899	$2,046,555
Ultra-fast charging station utilization (hours/day)	5.4	7.2	9	6	7.2	9	4.5	5.4	9
H_2 station throughput (kg/dispenser/day)	1,000	1,350	1,700	570	1,000	1,340	720	1,000	1,100

*Hydrogen stations are sized to store and dispense the necessary amount of hydrogen required for that application, so station costs are not directly comparable across years.

SENSITIVITY ANALYSIS RESULTS

Table A4. Sensitivity of infrastructure and TCO cost estimates for long-haul electric tractor-trailer to key assumptions

Scenario	Impact on infrastructure cost	Impact on total cost of ownership
Battery size: From 600 kWh to 900 kWh	-18.4%	0.4%
Battery size: From 600 kWh to 400 kWh	12.2%	1.1%
Efficiency: 15% higher energy consumption	14.4%	9.4%
Efficiency: 15% lower energy consumption	-15.0%	-9.2%
Opportunity charging: No loading dock charging	-2.6%	1.2%
Opportunity charging: Charging at 66% of loading docks	2.6%	-1.2%

Note. All numbers reported in terms of difference from baseline scenario for 2030 (high-volume case).

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

SENT VIA E-MAIL AND USPS: March 20, 2018

ohernandez@fontana.org
Orlando Hernandez, Planning Manager
City of Fontana – Planning Division
8353 Sierra Avenue
Fontana, CA 92335

Second Recirculated Draft Environmental Impact Report (RDEIR) for the Proposed West Valley Logistics Center Specific Plan (SCH No.: 2012071058)

The South Coast Air Quality Management District (SCAQMD) 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[1].

SCAQMD Staff's Summary of Project Description

The Lead Agency proposes to develop a guiding document to develop seven industrial warehouse buildings of up to 3,473,690 square feet with unknown occupants on an approximately 291.31-acre site that is currently vacant (Proposed Project). The Second RDEIR estimated a new total of 6,382 trip-ends per day (actual vehicles – automobiles and trucks), including 2,432 truck trip-ends per day with an average trip length of 38 miles for heavy trucks and 17.4 miles for all other vehicles[2]. Based on a review of Figure 3-1 and Table 4.2.2-1 in the Second RDEIR and aerial photographs, SCAQMD staff found that the Proposed Project is surrounded by sensitive receptors (residential uses and schools) to the north, east, and south. Construction is expected to take no more than 24 months for each increment of development, and construction may be phased with no specific development order[3].

SCAQMD Staff's Summary of Air Quality and Health Risk Assessment Analyses

In the Air Quality Section, the Lead Agency quantified the Proposed Project's construction and operational emissions and compared those emissions to SCAQMD's recommended regional and localized air quality CEQA daily significance thresholds. To represent a worse-case analysis scenario, construction emissions were modeled assuming the entire site was built at a single time[4]. After incorporating Mitigation Measures AQ-1 through AQ-9, construction emissions would be less than significant, except NOx with maximum daily emissions of 248.91 pounds per day exceeding the SCAQMD CEQA significance threshold for NOx of 100 pounds per day[5]. For operation, the Lead Agency assumed five percent of trucks serving the Proposed Project, and up to five percent of warehouse area would be climate controlled[6]. The Lead Agency found that the Proposed Project's operational emissions, after incorporating Mitigation Measures AQ-10 through AQ-14, would remain significant and unavoidable for VOC and NOx. In addition, the Lead Agency conducted a health risk assessment (HRA) based on the 2003 Office of Environmental Health Hazard Assessment (OEHHA) Guidelines and found that the maximum incremental cancer risk for residential exposure to diesel particulate matter (DPM) emissions

[1] On February 12, 2015, SCAQMD staff provided comments on the 1st RDEIR (available at: http://www.aqmd.gov/docs/default-source/ceqa/comment-letters/2015/february/deirwestvalley.pdf), which is incorporated here by reference.
[2] Second RDEIR. Page 4.2.2-17.
[3] Second RDEIR. Footnote 2; Page 3-18. Page 3-34. Table 4.2.2-5; Page 4.2.2-15.
[4] Second RDEIR. Page 3-18.
[5] Second RDEIR. Table 4.2.2-10. Page 4.2.2-31.
[6] Second RDEIR. Page 4.2.2-35.

would be 3.6 in a million; 0.53 in one million for workers; and 0.05 in one million for school child[7]. All of them would be below SCAQMD's CEQA significance threshold of 10 in one million for cancer risk.

General Comments

SCAQMD staff has reviewed the Air Quality and HRA analyses in the Second RDEIR and has comments on the air quality methodology and HRA modeling parameters. Please see the attachment for more information. Because of SCAQMD staff's concern about the health impacts from siting warehouses in proximity to sensitive land uses, the attachment includes additional recommended mitigation measures. Finally, the attachment includes SCAQMD staff's recommendation to include discussions on SCAQMD Rule 403(e), Rule 1166, and Rule 1466.

Pursuant to California Public Resources Code Section 21092.5(a) and CEQA Guidelines Section 15088(b), SCAQMD staff requests that the Lead Agency provide SCAQMD 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 or useful to decision makers and the public who are interested in the Proposed Project.

SCAQMD staff is available to work with the lead agency to address these issues and any other questions that may arise. Please contact me at lsun@aqmd.gov if you have any questions regarding the enclosed comments.

Sincerely,

Lijin Sun

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

Attachment
LS/SW
SBC180206-02
Control Number

[7] Second RDEIR. Pages 4.2.2-44 and 45.

ATTACHMENT

Overall Comment on Air Quality and Health Risk Assessment Analyses

1. The Lead Agency proposes to construct and operate approximately 3.5 million square feet of warehouse buildings. Occupants are unknown at the time the Second RDEIR is circulated for public review. Because future occupants of the Proposed Project are unknown, the Proposed Project could be utilized as a cold storage warehouse.

   Here, there was an inconsistency regarding whether the Proposed Project would include refrigerated units. Transport refrigeration units (TRUs) are commonly in-use at cold storage warehouses. Based on a review of the CalEEMod input file, SCAQMD staff found that the "***unrefrigerated*** warehouse-no rail" land use was selected. However, since up to five percent of the Proposed Project's warehouse area would be climate controlled[8], TRUs may be used during operation. To conservatively analyze the worst-case impact scenario and to be consistent with the intended uses of the Proposed Project, SCAQMD staff recommends that the Lead Agency revise the air quality and the HRA modeling to calculate operational emissions from NOx and diesel toxic particulate matter from TRUs and disclose them in the Final EIR.

Air Quality Analysis – Overlapping Construction and Operational Impacts

2. Since the Proposed Project may be developed in phases with no specific development order, the Proposed Project's construction activities in one Planning Area may overlap with operation of new warehouse buildings that are built in other Planning Areas, thereby resulting in overlapping construction and operational activities at one time. In the case of overlapping construction and operation activities, SCAQMD staff recommends adding the construction and operational peak daily emissions in pounds per day and comparing the combined emissions to SCAQMD's air quality CEQA significance thresholds for ***operation***[9] to determine the level of significance.

Health Risk Assessment (HRA)

3. The SCAQMD meteorological (MET) dataset (2008-2012) from the Fontana Station was used in the HRA. This dataset has been replaced with a new MET dataset (2011-2013, 2015, and 2016). Using the old MET dataset may have led to an under-estimation of the health risks from the Proposed Project. Therefore, SCAQMD staff recommends that the Lead Agency revise the HRA in the Final EIR by using the most recent MET dataset (2011-2013, 2015, and 2016) from Fontana Station that is available on SCAQMD's website[10].

4. Trucks idling emissions were estimated based on 15 minutes of idling time to serve as a conservative estimation of impacts from idling emissions. However, the modeled emission rate for truck idling emissions was calculated based on a division by the total number of seconds in an entire day (24 hours or 1440 minutes or 86,400 seconds) instead of the total number of seconds over a 15-minute duration. Dividing 15 minutes by the total number of seconds in an entire day may have resulted in lower than the actual emission rate in the model input and led to an under-estimation of

---

[8] Second RDEIR. Page 4.2.2-35.

[9] South Coast Air Quality Management District. *Air Quality Significance Thresholds*. Accessed at: http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf.

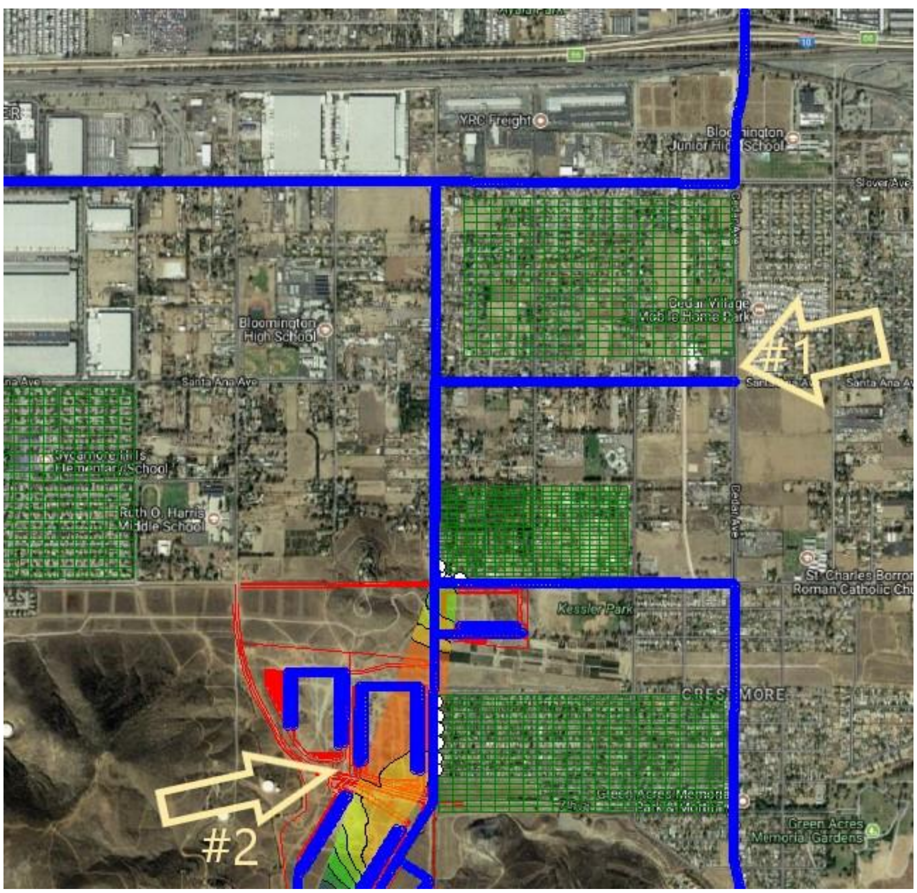
[10] South Coast Air Quality Management District. The AERMOD-ready Meteorological Data for Riverside Airport Station is available at: http://www.aqmd.gov/docs/default-source/air-quality/meterorological-data/aermod-ready-meteorological-data/table-1-meteorological-sites/2017/FontanaADJU.zip.

concentrations and risks. Therefore, SCAQMD staff recommends that the Lead Agency revise the emission rate for truck idling emissions in the model input.

5. On-site idling was modeled as line volume source with higher plume height and width. This approach is not appropriate because it may have likely increased dispersion and led to an under-estimation of ground level concentrations. Therefore, the point source option with the actual plume height and stack parameter settings should be used in the AERMOD, or the Lead Agency provides justification for the use of line volume source in the Final EIR.

6. The truck routes were not consistent. Based on a review of Figure 3-4, *Proposed Truck Route*, in the Second RDEIR, SCAQMD staff found that trucks would travel on Cedar Avenue between Slover Avenue and Jurupa Avenue. However, in the AERMOD modeling input files for the HRA analysis, truck route stopped at Cedar Avenue, and trucks would not travel on Cedar Avenue (See #1 in Figure A below). In addition, while a new private street would be constructed to provide ingress and egress for the proposed warehouses, it was not included as part of the truck route in the AERMOD modeling input files (See #2 in Figure A below). Therefore, it is recommended that the Lead Agency clarify the truck routes in the Final EIR and, if necessary, update the HRA analysis based on one set of truck routes that is consistent throughout the document, or provide justification to explain why different truck routes should be used in the HRA analysis.

Figure A: Screenshot from the AERMOD Modeling for the Proposed Project



NOTE: truck routes are shown in blue lines in the AERMOD modeling for the Proposed Project.

7. Trucks traveling on the roadways were modeled as single line volume sources in the AERMOD for the HRA analysis. However, based on a review of the most current aerial map, several roadways, as part of the proposed truck routes for the Proposed Project, including Cedar Avenue, Slover Avenue, and Sierra Avenue, have two to three lanes. Modeling these roadways as single line volume sources could have under-estimated the ground level concentrations, unless they reflect the actual road width that the trucks can and will travel. Therefore, to conduct a worst-case emissions scenario analysis from trucks traveling on these roadways, it is recommended that the Lead Agency revise the AERMOD modeling by using a correct lane type to reflect the actual road width.

8. As a sustainable feature (SP-AQ-3) for the Proposed Project's construction and operation, contractors and building operators are requested, by contract specification, that on-road heavy-duty diesel trucks with a gross vehicle weight rating greater than 14,000 pounds will have a 2010 model year engine or newer or will be equipped with a particulate matter trap, as available[11]. Based on Appendix 4, *Vehicle Categories*, in the User Guide for the U.S. EPA-approved EMFAC2014[12], the gross vehicle weight rating for Light-Heavy-Duty Trucks (LHD1) is from 8,501 to 10,000 pounds that is below the gross vehicle weight rating of 14,000 pounds. As such, LHD1 are not subject to SP-AQ-3. However, in the HRA modeling, the 2010 model year trucks or newer requirement was applied to all truck categories, including LHD1. To be consistent with SP-AQ-3's requirement, which, as it is currently written in the Second RDEIR, excludes LHD1, the Lead Agency should incorporate SP-AQ-3 requirement to re-calculate truck emissions for only Medium-Heavy Duty Trucks (MHD) and Heavy-Heavy Duty Trucks (HHD), not including LHD1. Alternatively, the Lead Agency should incorporate the following changes to SP-AQ-3 to be consistent with the modeling assumptions. Specifically, the Lead Agency should remove the gross vehicle weight rating requirement from SP-AQ-3 and ensure that a 2010 model year engine or newer will be used throughout the lifetime of the Proposed Project, not based on availability.

    SP-AQ-3: Request Contractors and Building Operators to Use Particulate Matter Traps on All On-road Heavy-Duty Diesel Trucks. The project will request contractors and building operators (by contract specifications) that on-road heavy-duty diesel trucks ~~with a gross vehicle weight rating greater than 14,000 pounds~~ have a 2010 model year engine or newer or are equipped with a particulate matter trap~~, as available~~.

9. In Appendix 2.4, *DPM Emissions From Project*, and the AERMOD modeling input files for the Proposed Project's HRA analysis, the weighted average emissions for trucks were derived from multiplying the percentage and emission factor for each of the three truck categories (LHD1, MHD, and HHD). The total combined percentage for trucks from all three categories should be 100 percent. However, the total combined percentage from LHD1, MHD, and HHD in the AERMOD modeling input files was approximately 80 percent. This would result in under-estimated truck emissions and associated health risks. Therefore, it is recommended that the Lead Agency update the percentages for the three truck categories to ensure that they add up to 100 percent and revise the associated truck emissions and the health risk values accordingly.

10. The building downwash effect was not included in the AERMOD. The building downwash is the effect that wind flowing over or around buildings has on plumes released from nearby stacks. Buildings create a cavity of recirculating winds in the area near the buildings, and these building cavities cause increased vertical dispersion of plumes emitted from stacks on or near the buildings. In addition, building downwash often leads to elevated concentrations downwind of the affected stacks.

---

11 Second RDEIR. Page 3-17 and 3-24.

12 California Air Resource Board. *EMFAC2014 User Guide*. Accessed at: https://www.arb.ca.gov/msei/emfac2014_users_guide.pdf.

Since the Proposed Project would include operation of seven warehouse buildings totaling 3,473,690 square feet, the building downwash effect should be used in the air dispersion model; or the Lead Agency should provide justification for not including the building downwash effect in the Final EIR.

11. In the HRA, the Lead Agency estimated the Proposed Project's health risks by using a single lifetime calculation rather than individual age bins (e.g., third trimester of pregnancy, age 0-2, age 2-16, and age 16-30). The 2015 Office of Environmental Health Hazard Assessment (OEHHA) Guidance acknowledges that children are more susceptible to the exposure to air toxics and has revised the way cancer risks are estimated to take this into account (e.g., increasing the risks for children from cancer causing substances, elevating the breathing rates for children, and adding multi-pathway calculations). Additionally, each age bins has different exposure parameters, including, for example, daily breathing rates, age sensitivity factors, and faction of time at home. Table A and Table B below illustrate the differences in exposure parameters for different age bins.

Table A: Residential Daily Breathing Rates for Point Estimate Dose Calculation (L/kg body weight)

	3rd trimester	**0-2 Years**	**2-9 Years**	**2-16 Years**	**16-30 Years**	**16-70 Years**
Average	225	658	535	452	210	185
80th Percentile	273	758	631	572	261	233
95th Percentile	361	1090	861	745	335	290

Source: 2015 OEHHA Guidance.

When calculating cancer risks, the age sensitivity factors (ASF) accounts for greater susceptibility in early life, starting from the 3rd trimester of pregnancy to 70 years. Another factor in the cancer risk calculations is the fraction of time at home (FAH), which takes into account the time actually residing at the sensitive receptor location(s). The FAH is also age-dependent. In general, the earlier in life the greater fraction of time at home (See Table B). Therefore, the age factor plays an important role in health risk calculation.

Table B: FAH for Evaluating Residential Cancer Risk

Age Range	**FAH**
3rd Trimester and 0-2 Years	0.85
2-16 Years	0.72
16-70 Years	0.73

Source: 2015 OEHHA Guidance.

Although truck emissions will get cleaner over time due to implementation of stringent regulations and improving technologies, it would not be appropriate to average emissions over the entire exposure duration since this would substantially underestimate health risks to children who would be exposed to higher DPM concentrations during the early years of project operation. Therefore, SCAQMD staff recommends that the Lead Agency calculate cancer risks separately for each age bin in the Final EIR. The DPM emissions for each year of operation should be applied to each of the corresponding age bins (i.e. emissions from Year 1 of Project operation should be used to estimate cancer risks to the third trimester to 0 year age bin; Year 1 and 2 of Project operation should be used to estimate the cancer risks to the 0 to 2 years age bins; and so on). When there are different breathing rates for the same age bin, the most appropriate and conservative daily breathing rate should be used.

Mitigation Measures

12. CEQA requires that all feasible mitigation measures that go beyond what is required by law be utilized to minimize or eliminate any significant adverse impacts. SCAQMD staff recommends incorporating the following mitigation measures in the Final EIR to further reduce health impacts to near sensitive receptors.

Vegetated Barriers and Limitations

a) Based on a review of Figure 3-3 in the Second RDEIR and aerial photographs, SCAQMD staff found that screen walls will be installed in some parts of the Proposed Project and that some vegetation already exist along the easterly property line between Building 1 and Lincoln Avenue. Due to SCAQMD staff's concern about siting the Proposed Project next to residential uses, it is recommended that the Lead Agency use vegetative barriers of sufficient density as a measure to reduce exposures to residents. For additional information on road side vegetation barriers, please visit: https://www.epa.gov/air-research/recommendations-constructing-roadside-vegetation-barriers-improve-near-road-air-quality.

However, vegetative barriers have limitations. According to the EPA's Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality Planning Guide[13], gaps in vegetative barriers can lead to increased pollutant concentrations downwind. Furthermore, vegetative barriers require several years to reach full maturity (width, height, and density); therefore, creating potential gaps and increased pollutant concentrations downwind. The EPA also recommends extending the barrier at least 50 meters laterally beyond the area of concern in order to maximize reductions in downwind concentrations. Therefore, in the event that vegetated barriers are proposed for the Proposed Project, the Lead Agency should consider and carefully evaluate the presumed effectiveness in more detail prior to assuming that they will sufficiently alleviate exposures to DPM emissions.

Require Setbacks of at least 500 feet as a Project Design Feature

b) Because of the close proximity of the Propose Project such as Building 1 to existing residential uses, SCAQMD staff recommends that the Lead Agency include in the project design feature setbacks of at least 500 feet, where appropriate.

Compliance with SCAQMD Rules 403(e), 1166, and 1466

13. The Lead Agency included a discussion on general compliance with SCAQMD Rule 403 in the Second RDEIR. Based on the project description, the Proposed Project is a large operation of approximately 291 acres (50-acre sites or more of disturbed surface area; or daily earth-moving operations of 3,850 cubic yards or more on three days in any year) in the South Coast Air Basin. The Lead Agency is required to comply with SCAQMD Rule 403(e) – Additional Requirements for Large Operations[14], which includes requirements to provide Large Operation Notification Form 403 N, appropriate signage, additional dust control measures, and employment of a dust control supervisor

[13] EPA Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality Planning Guide. Accessed at: https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=528612.

[14] South Coast Air Quality Management District. Rule 403. Last amended June 3, 2005. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-403.pdf.

that has successfully completed the Dust Control in the South Coast Air Basin training class[15]. Therefore, SCAQMD recommends that the Lead Agency include a discussion to demonstrate specific compliance with SCAQMD Rule 403(e) in the Final EIR.

14. Based on a review of Section 4.2.-8, *Hazards and Hazardous Materials*, SCAQMD staff found that the Proposed Project site was historically used for agriculture from 1953 to 2005[16]. Organochlorine pesticides was used. While the results of soil testing indicated no organochlorine pesticides present in surficial soils, should the Lead Agency encounter hydrocarbons during soil disturbance activities, the Proposed Project is subject to SCAQMD Rule 1166 – Volatile Organic Compound Emissions from Decontamination of Soil. Therefore, SCAQMD staff recommends that the Lead Agency include a discussion to demonstrate compliance with Rule 1166 in the Final EIR.

15. Due to earth-moving activities of soil on the Proposed Project site, and in the event that any toxic air contaminant(s) as defined in SCAQMD Rule 1466 – Control of Particulate Emissions from Soil with Toxic Air Contaminants[17] are encountered, the Final EIR should include a discussion on Rule 1466.

---

15 South Coast Air Quality Management District Compliance and Enforcement Staff's contact information for Rule 403(e) Large Operations is (909) 396-2608 or by e-mail at dustcontrol@aqmd.gov.

16 Second RDEIR. Page 4.2.8-5.

17 South Coast Air Quality Management District. Rule 1466. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1466.pdf.

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

SENT VIA E-MAIL AND USPS: May 24, 2019
agilbert@cityofchino.org
Andrea Gilbert, Senior Planner
Development Services Department
City of Chino
13220 Central Avenue
Chino, CA 91710

Draft Environmental Impact Report (Draft EIR) for the Proposed Altitude Business Centre Project (SCH No.: 2017051060)

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 87,000 square feet of existing residential and agricultural/dairy uses and construct 25 buildings for general light industrial, warehouse, business park, and self-storage uses totaling 1,219,015 square feet on 72 acres (Proposed Project). The Proposed Project is located on the southeast corner of Kimball Avenue and Euclid Avenue in the City of Chino. Construction is anticipated to begin in 2018 and will occur in three phases (Phases 1, 2, and 3) over a three-year period with overlapping construction and operational years, as suggested by the Traffic Impact and Noise Analysis[1]. The Proposed Project is anticipated to be fully operational by 2020[2]. During operations, the Proposed Project is expected to generate 1,317 truck trips per day[3].

South Coast AQMD Staff's Summary of Air Quality Analysis

In the Air Quality Analysis section, the Lead Agency quantified the Proposed Project's construction and operational emissions and compared those emissions to South Coast AQMD's recommended regional and localized air quality CEQA significance thresholds. Based on the analyses, the Lead Agency found that the Proposed Project's regional and localized construction air quality impacts would be significant for NOx at 159.30 pounds per day (lbs/day)[4]. However, with the implementation of Mitigation Measure (MM) 4.3-3, which requires that, during grading activities, all off-road diesel-powered construction equipment greater than 150 horsepower (hp) meet Tier 3 standards[5], construction–related NOx emissions would be reduced to 86.07 lbs/day[6], which is below South Coast AQMD's air quality CEQA significance threshold for construction. The Lead Agency also found that with the implementation of MMs 4.3-5 through 4.3-8, which include vehicle idling restrictions, and among other requirements, the use of electric cargo handling equipment, the Proposed Project's operational air quality impacts would remain significant and unavoidable for NOx emissions at 486.14 lbs/day[7]. The Lead Agency also prepared a mobile source Health Risk Assessment (HRA), and compared the results to South Coast AQMD's CEQA

---

1 Draft EIR. Section 4.10 Noise and Section 4.11 Transportation Traffic.
2 *Ibid*. Appendix B: Air Quality Impact Analysis, Health Risk Assessment (HRA) and Supplemental Air Quality Assessment. Page 36.
3 *Ibid*. Section 3 Project Description. Page 3-21.
4 *Ibid*. Section 4.3 Air Quality. Page 4.3-20.
5 *Ibid*. Page 4.3-28.
6 *Ibid*.
7 *Ibid*. Page 4.3-25 through 29.

significance threshold of 10 in one million for cancer risk[8]. The Lead Agency found that the Proposed Project's air quality impacts from operations would result in a cancer risk of 6.5 in one million[9]. Additionally, the Lead Agency discussed South Coast AQMD Rules specific to the Proposed Project, such as Rule 1403 – Asbestos Emissions from Demolition/Renovation Activities[10].

South Coast AQMD's 2016 Air Quality Management Plan

On March 3, 2017, the South Coast AQMD's Governing Board adopted the 2016 Air Quality Management Plan (2016 AQMP)[11], which was later approved by the California Air Resources Board on March 23, 2017. Built upon the progress in implementing the 2007 and 2012 AQMPs, the 2016 AQMP provides a regional perspective on air quality and the challenges facing the South Coast Air Basin. The most significant air quality challenge in the Basin is to achieve an additional 45 percent reduction in nitrogen oxide (NOx) emissions in 2023 and an additional 55 percent NOx reduction beyond 2031 levels for ozone attainment.

South Coast AQMD Staff's General Comments

South Coast AQMD staff has comments on the Air Quality and HRA analyses. The Lead Agency did not analyze a scenario where construction activities of one development phase overlap with operational activities of one or two development phases. Additionally, South Coast AQMD staff found that the Lead Agency used different exposure parameters for a 30-year residential cancer risk than those discussed in the main body of the HRA in the Draft EIR. Please see the attachment for more information. In the event that the Lead Agency finds that, after revisions to the Air Quality Analysis, the Proposed Project will result in significant air quality impacts during construction, mitigation measures will be required. Additionally, since the Proposed Project will result in significant and unavoidable NOx emissions during operation, South Coast AQMD staff recommends that the Lead Agency require further operational mitigation measures. The attachment includes a list of potential mitigation measures as guidance to the Lead Agency that should be reviewed for incorporation in the Final EIR. The attachment also includes recommendations to include discussions of South Coast AQMD rules that may be applicable to the Proposed Project.

Conclusion

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, when the Lead Agency makes the finding that the recommended changes to the existing MMs 4.3-3 and 4.3-6 and new mitigation measures are not feasible, the Lead Agency should describe the specific reasons for rejecting them in the Final EIR (CEQA Guidelines Section 15091).

---

[8] South Coast AQMD has developed the CEQA significance threshold of 10 in one million for cancer risk. When South Coast AQMD acts as the Lead Agency, South Coast AQMD staff conducts a HRA, compares the maximum cancer risk to the threshold of 10 in one million to determine the level of significance for health risk impacts, and identifies mitigation measures if the risk is found to be significant.

[9] Draft EIR. Appendix B: Air Quality Impact Analysis, Health Risk Assessment (HRA) and Supplemental Air Quality Assessment. Page 1.

[10] South Coast AQMD. Rule 1403 – Control of Emissions from Demolition/Renovation Activities. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1403.pdf

[11] South Coast AQMD. March 3, 2017. *2016 Air Quality Management Plan*. Accessed at: http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgt-plan.

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, should you have any questions.

Sincerely,

Lijin Sun

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

Attachment
LS:AM
SBC190501-16
Control Number

ATTACHMENT

Air Quality Impact Analysis – Overlapping Construction and Operational Impacts

1. Based on a review of the Air Quality Analysis, South Coast AQMD staff found that the Lead Agency did not consider nor analyze a scenario where construction activities overlap with operational activities (e.g., one phase implementing the Proposed Project is operational while another phase implementing the Proposed Project is under construction). Since implementation of the Proposed Project is expected to occur over a multi-year timeframe of three years from 2018 to 2020[12], an overlapping construction and operation scenario is reasonably foreseeable, unless the Proposed Project includes requirement(s) that will prohibit overlapping construction and operational activities. To conservatively analyze a worst-case impact scenario that is reasonably foreseeable at the time the Draft EIR is prepared, South Coast AQMD staff recommends that the Lead Agency use its best efforts to identify the overlapping construction and operational years, 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.

Health Risk Assessment Analysis

2. Upon a review of Appendix B: Air Quality Impact Analysis, Health Risk Assessment (HRA) and Supplemental Air Quality Assessment[13] and the technical files[14], South Coast AQMD staff found that the Lead Agency discussed the exposure parameters for residents, school, and offsite worker scenarios based on the 2015 OEHHA Guidelines. Upon further review of the detailed health risk calculations, South Coast AQMD staff found that the Lead Agency used different exposure parameters than those discussed in the main body of the Draft EIR. For example in the main body of the Draft EIR, the Lead Agency discussed the exposure assumptions for a 30-year residential cancer risk for age bins "0 to 2" and "2 to 16". The respective daily breathing rates are 1090 and 572, and the respective age sensitivity factors are 10 and 3[15]. Upon a review of the exposure factors used to calculate contaminant intake, South Coast AQMD staff found that for age bins "0 to 2" and "2 to 16" the Lead Agency used a different daily breathing rate of 461 and a different age sensitivity factor of 2.6[16]. Therefore, South Coast AQMD staff recommends that the Lead Agency provide an explanation for using different breathing rates and age sensitivity factors in the risk calculations than those discussed in the main body of the Draft EIR. Alternatively, South Coast AQMD staff recommends the Lead Agency revise the HRA to use the most conservative risk exposure parameters to estimate the Proposed Project's cancer risk in the Final EIR.

Recommended Revisions to Existing Mitigation Measures

3. The Lead Agency has committed to implementing mitigation measures to reduce the Proposed Project's significant air quality impacts from construction and operations. These mitigation measures include, but are not limited to, Mitigation Measure (MM) 4.3-3 and MM 4.3-6. MM 4.3-3 requires that during grading activities, construction equipment greater than 150 horsepower shall be California Air Resources Board (CARB) Tier 3 Certified or better. MM 4.3-6 requires that, at a minimum, the Proposed Project is designed to include preferential parking for clean air vehicles, the use of electric-powered cargo handling equipment, and installation of water efficiency features. To further reduce the Proposed Project's air quality impacts, particularly from NOx emissions during operation, South

---

[12] Draft EIR. Section 1 Executive Summary. Page 1-4.
[13] *Ibid*. Appendix B: Air Quality Impact Analysis, Health Risk Assessment (HRA) and Supplemental Air Quality Assessment.
[14] *Ibid*. Appendix 2.2.: Risk Calculations.
[15] *Ibid*. Appendix B: Air Quality Impact Analysis, Health Risk Assessment (HRA) and Supplemental Air Quality Assessment. Page 17.
[16] *Ibid*.

Coast AQMD staff recommends that the Lead Agency incorporate the following revisions to existing mitigation measures in the Final EIR.

MM 4.3-3

Prior to grading permit issuance, the City of Chino Planning Division and City of Chino Engineering Division shall review and approve a construction management plan in accordance with City of Chino Municipal Code Section 20.23.210. The construction management plan shall include the following note. Project contractors shall be required to comply with these notes and permit periodic inspection of the construction site by City of Chino staff to confirm compliance.

a) During ~~grading~~ all construction activity, all construction equipment with more than ~~150~~ 50 horsepower shall be California Air Resources Board (CARB) ~~Tier 3~~ Tier 4 Certified or better. Such equipment should be outfitted with Best Available Control Technology (BACT) devices including, but not limited to, a CARB certified Level 3 Diesel Particulate Filters (DPF). Level 3 DPFs are capable of achieving at least an 85 percent reduction in particulate matter emissions. A list of CARB verified DPFs are available on the CARB website. Additionally, the Lead Agency should include this requirement in applicable bid documents, and that successful contractor(s) must demonstrate the ability to supply compliant equipment prior to the commencement of any construction activities.

MM 4.3-6

Prior to the issuance of a building permit, the Project Applicant shall provide documentation to the City of Chino demonstrating that the Project is designed to exceed the California Energy Code (Title 24, Part 6) standards in effect at the time of building permit application submittal by three (3) percent and includes the energy efficiency design features listed below at a minimum.

a) The Lead Agency should ensure that the Proposed Project is constructed with the appropriate infrastructure to meet the three percent exceedance of the California Energy Code (Titel 24, Part 6) standards and facilitate sufficient electric charging for passenger vehicles and trucks to plug-in. Electrical panels should be appropriately sized to allow for future expanded use. The Lead Agency should also include analyses to evaluate and identify sufficient power available for zero emission passenger cars and trucks, and supportive infrastructures (e.g., EV charging stations) in the Energy and Utilities and Service Systems Sections of the Final EIR, where appropriate. Additionally, the Lead Agency should implement a rideshare program for warehouse and other commercial employees, and set a goal to achieve a certain participation rate over a period of time. The Lead Agency should provide incentives for employees to encourage the use of public transportation or carpooling, such as discounted transit passes, carpool rebates, such as preferential parking locations for carpool, vanpool, EVs and CNG vehicles;

b) All outdoor cargo handling equipment (e.g., yard trucks, hostlers, yard goats, pallet jacks, forklifts) shall be electric-powered; and

c) All fixtures installed in restrooms and employee break areas shall be U.S. EPA Certified WaterSense or equivalent.

Additional Recommended Mitigation Measures

4. 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. In the event that, upon revisions to the Air Quality Analysis based on Comment No. 1, the Lead Agency finds the Proposed Project would result in significant air quality impacts during construction, mitigation would be required (CEQA Guidelines Section 15126.4). South Coast AQMD staff has compiled a list of

recommended construction mitigation measures as suggested resources and guidance to the Lead Agency to assist in the identification of feasible mitigation measures for incorporation in the Final EIR. Additionally, to further reduce the Proposed Project's significant and unavoidable operational NOx emissions, and to facilitate the achievement of goals and attainment timelines outlined in the 2016 AQMP, South Coast AQMD staff recommends that the Lead Agency incorporate the following operational mitigation measures 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[17].

Mitigation Measure for Construction Air Quality Impacts

- Require the use of zero-emission (ZE) or near-zero emission (NZE) on-road construction haul trucks (e.g., material delivery trucks and soil import/export) such as heavy-duty trucks with natural gas engines that meet the California Air Resources Board (CARB)'s adopted optional NOx emission standard at 0.02 grams per brake horsepower-hour (g/bhp-hr). When requiring ZE or NZE on-road haul trucks, the Lead Agency should include analyses to evaluate and identify sufficient power and supportive infrastructure available for ZE/NZE trucks in the Energy and Utilities and Service Systems Sections of the Final EIR, where appropriate.

  At a minimum, require that construction vendors, contractors, and/or haul truck operators commit to using 2010 model year[18] or newer engines that meet CARB's 2010 engine emission standards at 0.01 g/bhp-hr of particulate matter (PM) and 0.20 g/bhp-hr of NOx emissions or newer, cleaner trucks. Early implementation of the Truck and Bus Regulation at the Proposed Project will help establish in the construction management plan a preference for construction contractor(s) who can supply 2010 model year trucks earlier than 2023, provide time and opportunities to resolve implementation challenges ahead of 2023, facilitate the transition to 2010 model year trucks in 2023, ease the costs and burden of regulatory compliance, and yield emission reductions from fleets earlier than 2023.

  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.

- 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.

[17] South Coast AQMD. Accessed at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook.

[18] 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.

- 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.

Mitigation Measures for Operational Air Quality Impacts from Mobile Sources

- Require the use of ZE or NZE heavy-duty trucks during operation, such as trucks with natural gas engines that meet CARB's adopted optional NOx emission standard of 0.02 grams per brake horsepower-hour (g/bhp-hr). At a minimum, require that operators of heavy-duty trucks visiting the Proposed Project during operation commit to using 2010 model year[19] or newer engines that meet CARB's 2010 engine emission standards of 0.01 g/bhp-hr for particulate matter (PM) and 0.20 g/bhp-hr of NOx emissions or newer, cleaner trucks. Include analyses to evaluate and identify sufficient power available for zero emission trucks and supportive infrastructures in the Energy and Utilities and Service Systems Sections of the Final EIR, where appropriate.

  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 operation, 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 operation meets the minimum 2010 model year engine emission standards. Alternatively, the Lead Agency should require periodic reporting and provision of written records by operators, and conduct regular inspections of the records to the maximum extent feasible and practicable.

- Limit the daily number of truck trips allowed at the Proposed Project to the level that was analyzed in the Final EIR (e.g., 1,317 daily truck trips). If higher daily truck volumes are anticipated during operation than what was analyzed in the Draft EIR, the Lead Agency should commit to re-evaluating the Proposed Project's air quality and health risks impacts through CEQA prior to allowing higher activity levels (CEQA Guidelines Section 15162).

- Require trucks to use the truck routes that were used to analyze the air quality and HRA impacts in the Final EIR.

- Enforce the City's designated truck routes, which are discussed in Appendix J: Traffic Impact Analysis (TIA)[20] of the Draft EIR.

- Have truck routes clearly marked with trailblazer signs, so that trucks will not enter residential areas that are adjacent to portions of the designated truck routes analyzed in the Final EIR.

- Restrict overnight truck parking in residential areas. Establish parking within the Proposed Project where trucks can rest overnight.

[19] 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.

[20] Draft EIR. Appendix J: Traffic Impact Analysis. Pages 63 and 68.

- Establish area(s) within the Proposed Project site for repair needs and ensure that these designated areas are away from any sensitive land uses.

Mitigation Measures for Operational Air Quality Impacts from Area Sources

- Maximize the use of solar energy including solar panels. Installing the maximum possible number of solar energy arrays on the building roofs and/or on the Proposed Project site to generate solar energy for the facility and/or EV charging stations.
- Require the use of electric landscaping equipment, such as lawn mowers and leaf blowers.
- Require use of electric or alternatively fueled sweepers with HEPA filters.
- Maximize the planting of trees in landscaping and parking lots.
- Use light colored paving and roofing materials.
- Utilize only Energy Star heating, cooling, and lighting devices, and appliances.

<u>Responsible Agency, Permits, and Compliance with South Coast AQMD Rules</u>

5. Implementation of the Proposed Project may require permits from South Coast AQMD. If operation of the Proposed Project will involve the use of stationary diesel-fueled internal combustion or compression engines (i.e., generators or firefighting equipment), South Coast AQMD Rule 1470 – Requirement for Stationary Diesel-Fueled Internal Combustion and Other Compression Ignition Engines[21] and South Coast AQMD Rule Series 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters[22], including Rule 1146.1 – Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters[23] and Rule 1146.2 – Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters[24] would apply and should be discussed in the Air Quality Section of the Final EIR. Therefore, South Coast AQMD staff recommends that the Lead Agency consult with South Coast AQMD Permitting and Engineering staff as early as feasible to determine permit requirements and any applicable rules and regulations that should be discussed in the CEQA document for the Proposed Project. Additionally, in the event that the Proposed Project will require new stationary equipment that requires a permit from South Coast AQMD, the Lead Agency should identify South Coast AQMD as a Responsible Agency for the Proposed Project in the Final EIR. Questions on permits and applicable South Coast AQMD rules can directed to South Coast AQMD's Engineering and Permitting staff at (909) 396-3385. For more general information on permits, please visit South Coast AQMD's webpage at: http://www.aqmd.gov/home/permits.

[21] South Coast AQMD. Rule 1470 – Requirement for Stationary Diesel-Fueled Internal Combustion and Other Compression Ignition Engines. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1470.pdf.

[22] South Coast AQMD. Rule 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146.pdf.

[23] South Coast AQMD. Rule 1146.1 – Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146-1.pdf.

[24] South Coast AQMD. Rule 1146.2 – Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters. Accessed at: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146-2.pdf.

ORDINANCE NO. 663
(AS AMENDED THROUGH 663.10)
AN ORDINANCE OF THE COUNTY OF RIVERSIDE AMENDING ORDINANCE NO. 663 ESTABLISHING THE RIVERSIDE COUNTY STEPHENS' KANGAROO RAT HABITAT CONSERVATION PLAN PLAN FEE ASSESSMENT AREA AND SETTING MITIGATION FEES

The Board of Supervisors of the County of Riverside Ordains as Follows:

Section 1. TITLE. This ordinance shall be known as the Stephens' Kangaroo Rat Mitigation Fee Ordinance.

Section 2. FINDINGS. The Board of Supervisors finds and determines that:

(a) The Stephens' Kangaroo Rat is listed as a threatened species by the State of California, and the California Department of Fish and Game has recommended changing its status to endangered.

(b) The U.S. Fish and Wildlife Service has listed the Stephens' Kangaroo Rat as an endangered species, effective October 31, 1988, pursuant to the Federal Endangered Species Act of 1973, 16 U.S.C. Section 1531 et. seq.

(c) Following the federal listing of the Stephens' Kangaroo Rat as an endangered species, occupied habitat of the species may not be altered without a Section 10(a) permit issued by the Secretary of the Interior. All requests for a Section 10(a) permit must be accompanied by a Habitat Conservation Plan approved by the U.S. Fish and Wildlife Service. Said permit will then allow for the loss of occupied habitat due to development on the basis that the Habitat Conservation Plan will provide protection for the species and guarantee its survival.

(d) Development within the historic range of the Stephens' Kangaroo Rat has resulted in loss and degradation of occupied Stephens' Kangaroo Rat habitat, increased isolation of Stephens' Kangaroo Rat populations, reduction of potential habitat areas for future colonization, and elimination of corridors which allow the species to relocate as environmental conditions warrant.

(e) The Stephens' Kangaroo Rat's survival cannot be insured on small isolated acreages surrounded by, or in close proximity to, development or human populations.

(f) Impacts to the Stephens' Kangaroo Rat are not limited to loss or degradation of actually occupied habitat only.

(g) The successful completion and implementation of a Habitat Conservation Plan for the Stephens' Kangaroo Rat would be jeopardized by not implementing a procedure that requires review of each proposed development within the Fee Assessment Area to determine the best means of mitigating impacts to the Stephens' Kangaroo Rat.

(h) Each proposed development project shall be reviewed to determine the most appropriate course of action to ensure the survival of the species through one or more of the following: (1) on-site mitigation of impacts to the Stephens' Kangaroo Rat through the reservation or addition of lands included within or immediately adjacent to a potential habitat reserve site, or (2) payment of the Mitigation Fee set by this ordinance or (3) any combination of (1) and (2) consistent with the intent and purpose of this ordinance. A proposed development project may be referred, for review, to Federal and State resource agencies based upon criteria which may be established and agreed upon by the County and said agencies.

(I) A program providing for off-site project mitigation in accordance with the development of a Habitat Conservation Plan will provide a mechanism for establishing sufficient habitat areas which can be effectively protected and managed for the Stephens' Kangaroo Rat's survival and recovery.

(j) Immediate implementation of this ordinance is necessary to make use of other potential funding opportunities for the development and implementation of a Habitat Conservation Plan for the Stephens' Kangaroo Rat.

(k) The successful completion of a Habitat Conservation Plan depends upon providing protection to potential habitat reserve sites until the mechanisms for land acquisition contained within the Plan can be put into effect.

(l) All Mitigation Fees collected pursuant to the provisions of this ordinance shall be used for the development, preparation and implementation of a Habitat Conservation Plan for the Stephens' Kangaroo Rat, including, but not limited to, the acquisition and management of habitat reserve sites, and for the application of a Section 10(a) permit under the Federal Endangered Species Act of 1973, as well as authorization to take the species pursuant to the California Endangered Species Act.

(m) Adoption of this ordinance will provide mitigation for projects within the historical range of the Stephens' Kangaroo Rat allowing said projects to proceed during the preparation and implementation of a Habitat Conservation Plan for the Stephens' Kangaroo Rat, provided said projects are not located in areas identified as and meeting the criteria for potential habitat reserve sites needed for the conservation of the species. The approval of such development projects could jeopardize the survival of the species and therefore would be inconsistent with a Habitat Conservation Plan, even if the Mitigation Fee is paid.

(n) Adoption and implementation of this ordinance demonstrates the County's intent to cooperate with federal and state agencies to provide for the survival of the Stephens' Kangaroo Rat.

(o) The passage of this ordinance is intended to be consistent with the requirements of state and federal environmental legislation, including the California Environmental Quality Act.

Section 3. PURPOSE. The purpose of this ordinance is to finance the preparation, development and implementation of a Habitat Conservation Plan, including the acquisition of habitat reserve sites, and the application for a Section 10(a) permit under the Federal Endangered Species Act of 1973. It is the further purpose of this ordinance to provide a method for mitigation of impacts to the Stephens' Kangaroo Rat caused by the loss of its habitat due to development during the preparation and implementation of a Habitat Conservation Plan and provide for habitat mitigation to be identified in the Habitat Conservation Plan. Mitigation of impacts to the Stephens' Kangaroo Rat will be accomplished through the review of each proposed development project within the Fee Assessment Area to determine whether on-site mitigation through the reservation or addition of lands included within or immediately adjacent to a potential habitat reserve site or payment of the Mitigation Fee or a combination of both is appropriate and furthers the ultimate Habitat Conservation Plan objectives. A proposed development project may be referred, for review, to Federal and State resource agencies based upon criteria which may be established and agreed upon by the County and said agencies.

This ordinance provides for the establishment of this review process and satisfaction of on-site mitigation to protect potential habitat reserve sites or payment of the Mitigation Fee or a combination of both, which upon implementation will satisfy U.S. Fish and Wildlife Service, California Department of Fish and Game, as well as County mitigation requirements for the Stephens' Kangaroo Rat and its habitat which may occur within the unincorporated areas of the County designated herein.

<u>Section 4. DEFINITIONS.</u> As used in this ordinance, the following terms shall have the following meanings:

(a) **BOARD OF SUPERVISORS**. The Board of Supervisors of the County of Riverside.
(b) **CERTIFICATE OF OCCUPANCY**. "Certificate of Occupancy" shall mean a certificate of occupancy as defined by Ordinance No. 457 or state law.
(c) **COUNTY.** The County of Riverside.
(d) **DEVELOPMENT PERMIT.** County approval of a tentative tract map, tentative parcel map, conditional use permit, public use permit, plot plan, surface mining permit, or grading permit pursuant to the provisions of all applicable County ordinances. Where a development project has been previously reviewed and approved pursuant to the provisions of this ordinance, any subsequent implementing development permit shall not be subject to further review under this ordinance.
(e) **FEE ASSESSMENT AREA**. All real property located within the area as described in Section 5 of this ordinance.
(f) **FINAL INSPECTION**. "Final Inspection" shall mean a final inspection as defined by Ordinance No. 457 or state law.
(g) **HABITAT CONSERVATION PLAN**. A plan prepared pursuant to Section 10(a) of the Federal Endangered Species Act of 1973, 16 U.S.C. Section 1539.
(h) **MITIGATION FEE**. The fee imposed pursuant to the provisions of this ordinance.
(i) **PARCEL**. All real property for which a development permit is applied for.
(j) **RESIDENTIAL UNIT**. A building or portion thereof used by one (1) family and containing but one (1) kitchen, and designed for single family residential purposes only.
(k) **SECTION 10(a) PERMIT**. A permit issued by the Secretary of the Interior pursuant to Section 10(a) of the Federal Endangered Species Act of 1973, 16 U.S.C. Section 1539.
(l) **STEPHENS' KANGAROO RAT**. An animal species known as Dipodomys Stephensi.
(m) **GRADING PERMIT.** "Grading Permit" shall mean a grading permit as defined by Ordinance No. 457, provided, however, that for purposes of this ordinance, 'grading permit' shall not include the following:

  (1) A grading permit wherein grading was previously performed pursuant to a grading permit issued within one (1) year prior to November 15, 1988, and subsequently inspected and approved by the Riverside

County Department of Building and Safety. In addition, the area to be graded pursuant to said permit shall be the same or substantially the same area previously graded.

(2) A grading permit for real property upon which a detached or attached second unit will be constructed pursuant to Sections 18.28a and 18.28b of Ordinance 348.

Section 5. DESIGNATION OF THE FEE ASSESSMENT AREA.

All those certain lands located in the unincorporated areas of the County of Riverside, State of California, as hereinafter particularly described, are hereby designated as the Fee Assessment Area. Said
Fee Assessment Area is described as follows:

Beginning at the intersection of the West line of the Northeast 1/4 of the Northeast 1/4 of Section 11, Township 2 South, Range 5 West with the northerly boundary line of the County of Riverside, California.

Thence Southerly along the West line of the Northeast 1/4 of the Northeast 1/4 of said Section 11 to the Southwest corner thereof.

Thence Easterly along the South line of the Northeast 1/4 of the Northeast 1/4 of said Section 11 to the Southeast corner thereof.

Thence Southerly along the West line of Sections 12 and 13, Township 2 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of said Section 13 and the South line of Secti9ns 18 and 17, Township 2 South, Range 4 West to the Southeast corner thereof.

Thence Southerly along the West line of Sections 21, 28 and 33, Township 2 South, Range 4 West to the Southwest corner thereof.

Thence Westerly along the North line of Section 5, Township 3 South, Range 4 West to the Northwest corner thereof.

Thence Southerly along the West line of said Section 5 to the Southwest corner thereof.

Thence Westerly along the North line of Section 7, Township 3 South, Range 4 West and the North line of Sections 12, 11 and 10, Township 3 South, Range 5 West to its intersection with the centerline of Victoria Avenue in the City of Riverside, California.

Thence Southwesterly along said centerline of Victoria Avenue to its intersection with the North line of Section 19, Township 3 South, Range 5 West.

Thence Westerly along the North line of said Section 19 and the North line of Section 24, Township 3 South, Range 6 West to the Northwest corner thereof.

Thence Southerly along the West line of said Section 24 to the Southwest corner thereof.

Thence Westerly along the North line of Sections 26 and 27, Township 3 South, Range 6 West to the Northwest corner thereof.

Thence Southerly along the West line of the Northwest 1/4 of said Section 27 to the Southwest corner thereof.

Thence Westerly along the North line of the Southeast 1/4 of Section 28, Township 3 South, Range 6 West to the Northwest corner thereof.

Thence Southerly along the West line of the Southeast 1/4 of said Section 28 and the West line of the East 1/2 of Section 33, Township 3 South, Range 6 West to the Southwest corner thereof.

Thence Southerly along the West line of the East 1/2 of the West 1/2 of Section 4, Township 4 South, Range 6 West to the Southwest corner thereof.

Thence Easterly along the South line of the East 1/2 of the West 1/2 and the South line of the West 1/2 of the East 1/2 of said Section 4 to the Southeast corner thereof.

Thence Southerly along the West line of the East 1/2 of the East 1/2 of Section 9, Townshnip 4 South, Range 6 West to the Southwest corner thereof.

Thence Easterly along the South line of the East 1/2 of the East 1/2 of said Section 9 to the Southeast corner thereof.

Thence Southerly along the West line of Section 15, Township 4 South, Range 6 West to the centerline of Cajalco Road.

Thence Southwesterly along the said centerline of Cajalco Road to its intersection with the centerline of Interstate 15.

Thence Southeasterly along said centerline Interstate 15 to its intersection with the West line of Section 1, Township 5 South, Range 6 West.

Thence Southerly along the West line of said Section 1 and the West line of the Northwest 1/4 of Section 12, Township 5 South, Range 6 West to the Southwest 1/4 thereof.

Thence Easterly along the South line of the Northwest 1/4 of said Section 12 to the Southeast corner thereof.

Thence Southerly along the West line of the Southeast 1/4 of said Section 12 to the Southwest corner.

Thence Easterly along the South line of said Section 12 to the Southeast corner thereof.

Thence Southerly along the West line of the North 1/2 of the North 1/2 of Section 18, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the North 1/2 of the North 1/2 of said Section 18 to the Southeast corner thereof.

Thence Southerly along the West line of the South 1/2 of the North 1/2 of Section 17, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the South 1/2 of the North 1/2 of said Section 17 to the Southeast corner thereof.

Thence Southerly along the West line of the South 1/2 of Section 16, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of said Section 16 to the Southeast corner thereof.

Thence Southerly along the West line of the North 1/2 of Section 2, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the North 1/2 of said Section 22 to the Southeast corner thereof.

Thence Southerly along the West line of the Southwest 1/4
of Section 23, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the Southwest 1/4 of said Section 23 to the Southeast corner thereof.

Thence Southerly along the West line of the Northeast 1/4 of Section 26, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the Northeast 1/4 of said Section 26 to the Southeast corner thereof.

Thence Southerly along the West line of the Southwest 1/4 of Section 25, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the Southwest 1/4 of said Section 25 to the Southeast corner thereof.

Thence Southerly along the West line of the East 1/2 of Section 36, Township 5 South, Range 5 West to the Southwest corner thereof.

Thence Easterly along the South line of the East 1/2 of said Section 36 to the Southeast corner thereof.

Thence Southerly along the West line of the Northwest 1/4 of Section 6, Township 6 South, Range 4 West to the Southwest corner thereof.

Thence Easterly along the South line of the Northwest 1/4 of said Section 6 to the Southeast corner thereof.

Thence Southerly along the West line of the Southeast 1/4 of said Section 6 to the Southwest corner thereof.

Thence Easterly along the South line of the Southeast 1/4 of said Section 6 to the Southeast corner thereof.

Thence Southerly along the West line of the Northwest 1/4 of Section 8, Township 6 South, Range 4 West to the Southwest corner thereof.

Thence Easterly along the South line of the Northwest 1/4 of said Section 8 to the Southeast corner thereof.

Thence Southerly along the West line of the Southeast 1/4 of said Section 8 to the Southwest corner thereof.

Thence Easterly along the South line of the Southeast 1/4 of said Section 8 to the Southeast corner thereof.

Thence Southerly along the West line of Section 16, Township 6 South, Range 4 West to the Southwest corner thereof.

Thence Easterly along the South line of said Section 16 to the Southeast corner thereof.

Thence Southerly along the West line of the West 1/2 of Section 22, Township 6 South, Range 4 West to the Southwest corner thereof.

Thence Easterly along the South line of the West 1/2 of said Section 22 of the Southeast corner thereof.

Thence Southerly along the West line of the Northeast 1/4 of Section 27, Township 6 South, Range 4 West to the Southwest corner thereof.

Thence Easterly along the South line of the Northeast 1/4 of said Section 27 to the Southeast corner thereof.

Thence Southerly along the West line of the Southwest 1/4 of Section 26 and the West line of the Northwest 1/4 of Section 35, Township 6 South, Range 4 West to the Southwest corner thereof.

Thence Easterly along the South line of the Northwest 1/4 of said Section 35 to the Southeast corner thereof.

Thence Westerly along the South line of projected Section 35 and Section 34, Township 6 South, Range 4 West to its intersection with the Northerly Boundary Line of The Santa Rosa Rancho.

Thence Southerly along the West line of the Southeast 1/4 of said Section 35 to the Southwest corner thereof.

Thence Northwesterly and Southwesterly along said boundary line to its intersection with the centerline of Via Serreno.

Thence Southwesterly along said centerline of Via Serreno and the centerline of Hombre Lane to its intersection with the centerline of Avenida La Cresta.

Thence Southeasterly along said centerline of Avenida La Cresta to its intersection with the centerline of Sierra Maria Road.

Thence Northerly along the centerline of Sierra Maria Road to its intersection with the centerline of Buenos Tiempos Road.

Thence Northwesterly along said centerline of Buenos Tiempos Road to its intersection with the centerline of Via Caballos.

Thence Southwesterly and Northwesterly along said centerline of Via Caballos to its intersection with the centerline of Avenida Castilla.

Thence Northeasterly along said centerline of Avenida Castilla to its intersection with the centerline of Avenida La Cresta.

Thence Northwesterly along said centerline of Avenida La Cresta to its intersection with Calle Centro.

Thence Northerly along said centerline of Calle Centro to its intersection with Avenida Arbolos.

Thence Easterly along said centerline of Avenida Arbolos to its intersection with the centerline of Via Majorca.

Thence Northeasterly along said centerline of Via Majorca ot its intersection with Via Vista Grande.

Thence Northeasterly along said centerline of Via Vista Grande to the most Westerly corner of Parcel 7 of Record of Survey recorded in Book 54, Page 59, in The County of Riverside, California.

Thence North 74 Degrees 38'39" East a distance of 532.45'.

Thence North 04 Degrees 15'22" East a distance of 800.00'.

Thence South 85 Degrees 44'38" East a distance of 4011.73'.

Thence North 54 Degrees 49'53" East a distance of 1308.88' to the Northeasterly boundary line of The Santa Rosa Rancho.

Thence Southeasterly along said Northeasterly boundary line to the most Easterly corner of Parcel 3 of a Parcel Map recorded in Book 106, Pages 29 through 36, in The County of Riverside, California.

Thence continuing South 47 Degrees 19'01" East along said Northeasterly boundary line a distance of 8883.69'.

Thence leaving said boundary line South 41 Degrees 42'23" West a distance of 185.62'.

Thence South 13 Degrees 07'27" East a distance of 185.97'.

Thence South 43 Degrees 24'26" West a distance of 1230.44'.

Thence South 11 Degrees 33'09" West a distance of 1121.89'.

Thence South 64 Degrees 12'10" West a distance of 1753.24" to an angle point in the boundary of Parcel Map No. 19515 recorded in Book 119, Pages 27 and 28, in the County of Riverside, California.

Thence Southwesterly along said boundary South 85 Degrees 50'07" West a distance of 1083.42'.

Thence North 02 Degrees 26'46" East a distance of 1171.03'.

Thence North 51 Degrees 08'17" East a distance of 311.41'.

Thence North 42 Degrees 05'20" West a distance of 443.63'.

Thence North 17 Degrees 33'08" West a distance of 556.92'.

Thence North 03 Degrees 11'26" East a distance of 751.38'.

Thence North 47 Degrees 40'31" West a distance of 226.42'.

Thence South 49 Degrees 25'04" West a distance of 740.54'.

Thence North 54 Degrees 33'51" West a distance of 1187.10'.

Thence North 30 Degrees 57'50" East a distance of 870.64'.

Thence North 79 Degrees 18'05" West a distance of 584.42'.

Thence North 39 Degrees 00'28" West a distance of 386.67'.

Thence South 60 Degrees 08'58" West a distance of 358.06'.

Thence South 35 Degrees 51'19" West a distance of 1063.12'.

Thence North 12 Degrees 26'34" West a distance of 858.58'.

Thence North 30 Degrees 44'33" East a distance of 481.79'.

Thence North 68 Degrees 19'30" West a distance of 462.92'.

Thence South 72 Degrees 55'47" West a distance of 418.38'.

Thence North 79 Degrees 18'03" West a distance of 397.36'.

Thence North 08 Degrees 58'06" East a distance of 701.96'.

Thence North 79 Degrees 34'51" West a distance of 817.94'.

Thence South 69 Degrees 36'06" West a distance of 329.91'.

Thence South 26 Degrees 53'49" West a distance of 580.01'.

Thence South 79 Degrees 38'43" West a distance of 785.06'.

Thence leaving said Parcel Map boundary in a Northwesterly direction North 52 Degrees 24'41" West a distance of 4453.07' to an angle point in the boundary line of Parcel Map No. 19516, recorded in Book 119, Pages 22 through 26, in the County of Riverside, California. Thence continuing Northwesterly along said boundary line North 69 Degrees 45'26" West a distance of 661.92' to the centerline of Slinton Keith Road as shown on said Parcel Map.

Thence Southerly along said centerline of Clinto Keith Road South 15 Degrees 58'45" West a distance of 1167.82' to the beginning of a tangent curve, concave to the East, and having a radius of 3600.00'.

Thence Southerly along said curve through a central angle of 14 Degrees 21'20" and having a length of 901.99'.

Thence South 01 Degrees 37'25" West a distance of 1010.95' to the beginning of a tangent curve, concave to the East, and having a radius of 6000.00'.

Thence Southerly along said curve Through a central angle of 05 Degrees 03'33" and having a length of 529.79'.

Thence South 03 Degrees 26'08" East a distance of 456.53' to the beginning of a tangent curve, concave to the West, and having a radius of 2000.00'.

Thence Southerly along said curve through a central angle of 15 Degrees 40'22" and having a length of 547.08'.

Thence leaving said centerline in a Westerly direction North 74 Degrees 25'38" West a distance of 7844.89' to an angle point on the most Westerly boundary line of Parcel Map No. 22375, recorded in Book 144, Pages 7 through 10, in The County of Riverside, California.

Thence Southerly along said boundary line South 12 Degrees 47'19" West a distance of 1707.19'.

Thence South 21 Degrees 58'58" West a distance of 3527.68' to a point on the centerline of Sierra Allena as shown on said Parcel Map.

Thence Easterly and Southeasterly along said centerline to its intersection with the centerline of Tenaja Road as shown on said Parcel Map.

Thence Southwesterly and Southerly along said centerline to a point, said point also being an intersection with the centerline of Avacado Mesa as shown on Parcel Map 19516, recorded in Book 77, Page 77, in The County of Riverside, California. Said point also being the beginning of a non-tangent curve, concave to the North, and having a radius of 1400.00'. A radial line from said point bears South 00 Degrees 22'28" West.

Thence Easterly along said curve and said centerline of Avacado Mesa through a central angle of 10 Degrees 04'02" and having a length of 245.99'.

Thence North 80 Degrees 18'26" East a distance of 559.10'.

Thence leaving said centerline along the Southerly boundary line of said Parcel Map South 01 Degrees 58'18" East a distance of 1125.46'.

Thence North 55 Degrees 45'24" East a distance of 819.60'.

Thence South 75 Degrees 03'27" East a distance of 797.86'.

Thence South 47 Degrees 33'58" East a distance of 608.30'.

Thence North 35 Degrees 37'25 East a distance of 978.34'.

Thence North 87 Degrees 44'52" East a distance of 839.89'.

Thence North 62 Degrees 38'14" East a distance of 2703.03'.

Thence South 54 Degrees 15'29" East a distance of 617.25'.

Thence North 78 Degrees 40'27" East a distance of 1462.83'.

Thence South 69 Degrees 27'30" East a distance of 2370.44'.

Thence South 20 Degrees 06'29" East a distance of 1570.29'.

Thence North 56 Degrees 07'25" East a distance of 777.48'.

Thence North 15 Degrees 23'24" East a distance of 906.54'.

Thence North 86 Degrees 25'18" East a distance of 1321.76'.

Thence North 65 Degrees 36'25" East a distance of 300.23'.

Thence North 19 Degrees 24'52" West a distance of 4974.39'.

Thence North 01 Degrees 51'13" East a distance of 785.93'.

Thence North 32 Degrees 04'45" West a distance of 380.82'.

Thence North 61 Degrees 22'38" West a distance of 669.33'.

Thence leaving the boundary of said Parcel Map North 45 Degrees 01'03" East a distance of 5251.91' to an angle point in the Northwesterly boundary line said Parcel Map No. 19516.

Thence Southeasterly along said boundary line South 15 Degrees 08'17" East a distance of 1653.19'.

Thence South 27 Degrees 02'39" West a distance of 368.26'.

Thence South 02 Degrees 47'23" East a distance of 742.67'.

Thence South 53 Degrees 14'19" East a distance of 720.31'.

Thence South 19 Degrees 31'44" East a distance of 916.70'.

Thence North 84 Degrees 07'41" East a distance of 711.71'.

Thence South 11 Degrees 22'53" East a distance of 424.06'.

Thence South 54 Degrees 58'53" East a distance of 179.72'.

Thence North 61 Degrees 33'54" East a distance of 396.56'.

Thence South 18 Degrees 51'58" East a distance of 636.64'.

Thence North 52 Degrees 26'17" East a distance of 1090.83'.

Thence South 54 Degrees 33'49" East a distance of 612.68'.

Thence South 13 Degrees 02'07" East a distance of 1024.25'.

Thence South 36 Degrees 58'48" East a distance of 526.98'.

Thence South 76 Degrees 34'31" East a distance of 681.25'.

Thence South 54 Degrees 54'12" East a distance of 941.25'.

Thence North 69 Degrees 28'21" East a distance of 553.52'.

Thence South 74 Degrees 21'23" East a distance of 653.97'.

Thence North 38 Degrees 52'12" West a distance of 2216.15'.

Thence North 28 Degrees 21'03" East a distance of 456.68'.

Thence North 81 Degrees 12'02" East a distance of 709.99'.

Thence leaving the boundary line of said Parcel Map South 24 Degrees 58'52" East a distance of 405.02' to the most westerly corner of Parcel 84 of Parcel Map recorded in Book 2, pages 42 through 68, in The County of Riverside, California.

Thence Northeasterly along the Northwesterly boundary line of said Parcel 84 North 43 Degrees 04'23" East a distance of 1355.03'to the most Westerly corner of Parcel 85 of said Parcel Map.

Thence Northeasterlly along the Northwesterly boundary line of said Parcel 85 North 65 Degrees 35'21" East a distance of 1437.56' to the centerline of DeLuz Road.

Thence Northerly and Northeasterly along said centerline to its intersection with the Northeasterly boundary line of The Santa Rosa Rancho.

Thence along said boundary line South 47 Degrees 19'01" East a distance of 6731.56'.

Thence South 47 Degrees 18'54" East a distance of 2168.17'.

Thence South 39 Degrees 48'45" East a distance of 5192.67'.

Thence leaving said boundary line North 44 Degrees 52 56" East a distance of 2590.77'.

Thence South 45 Degrees 05'53" East a distance of 1431.39'.

Thence South 44 Degrees 55'54" West a distance of 793.37'.

Thence South 38 Degrees 21'30" East a distance of 2638.92' to the beginning of a non-tangent curve, concave to the North, and having a radius of 4550.00'. A radial line bears North 00 Degrees 37'07" West.

Thence Northwesterly along said curve through a central angle of 06 Degrees 19'00" and having a length of 501.62'.

Thence North 83 Degrees 03'53" East a distance of 1140.23'.

Thence South 06 Degrees 56'07" East a distance of 44.00'.

Thence South 26 Degrees 16'04" East a distance of 369.98'.

Thence South 00 Degrees 43'59" West a distance of 259.98'.

Thence South 71 Degrees 46'11" East a distance of 305.00'.

Thence South 54 Degrees 16'11" East a distance of 380.00'.

Thence South 85 Degrees 16'27" East a distance of 439.97'.

Thence South 53 Degrees 46'16" East a distance of 269.99'.

Thence South 33 Degrees 59'30" East a distance of 348.67'.

Thence South 45 Degrees 28'43" East a distance of 300.81'.

Thence South 45 Degrees 30'01" East a distance of 226.24'.

Thence South 45 Degrees 28'43" East a distance of 1954.04'.

Thence South 44 Degrees 31'14" West a distance of 206.39'.

Thence South 15 Degrees 39'21" East a distance of 1945.58'.

Thence South 45 Degrees 26'04" East a distance of 1495.92'.

Thence South 19 Degrees 54'54" East a distance of 235.93'.

Thence South 70 Degrees 12'40" West a distance of 1495.31'.

Thence South 33 Degrees 28'43" East a distance of 543.70'.

Thence South 39 Degrees 45'49" East a distance of 408.24'.

Thence South 49 Degrees 04'11" East a distance of 1528.81'.

Thence South 50 Degrees 07'21" West a distance of 2306.79'.

Thence North 39 Degrees 47'24" West a distance of 370.04' to the Southeasterly boundary line of The Santa Rosa Rancho.

Thence Southwesterly along said Southeasterly boundary line of the Santa Rosa Rancho to its intersection with the West line of Section 24, Township 8 South, Range 3 West.

Thence Southerly along the West line of said Section 24 and the West line of Sections 25 and 36, Township 8 South, Range 3 West to the Southwest corner thereof. Said corner also being a point on the Southerly boundary line of the County of Riverside, California.

Thence Easterly along said Southerly boundary line to its intersection with the East line of the West 1/2 of the West 1/2 of Section 33, Township 8 South, Range 2 West.

Thence Northerly along the East line of the West 1/2 of the West 1/2 of said Section 33 to the Northeast corner thereof.

Thence Easterly along the South line of the East 1/2 of the West 1/2 of Section 28, Township 8 South, Range 2 West to the Southeast corner thereof.

Thence Northerly along the East line of the East 1/2 of the West 1/2 of said Section 28 to its intersection with the Southeasterly boundary line of the Little Temecula Rancho.

Thence from said intersection Northeasterly to the intersection of the centerline of De Portola Rd. and the centerline of Butterfield Stage Rd.

Thence along said centerline of De Portola Rd. a distance of 1110.00' said point being on a line between the Southeast corner of Section 14, Township 7 South, Range 2 West and the intersection of the North-South quarter section line of Section 28, Township 8 South, Range 2 West with the Southerly boundary line of The Little Temecula Rancho. Said line hereinafter referred to as Line "A".

Thence along said line "A" South 21 Degrees 03'43" West a distance of 3503.49'.

Thence leaving said line "A" North 83 Degrees 52'28" East a distance of 1391.95' to the beginning of a tangent curve concave to the Northeast and having a radius of 2000.00.

Thence Northwesterly along said curve through a central angle of 01 Degrees 07'57" a distance of 39.53'.

Thence North 22 Degrees 56'22" West a distance of 295.47' to the beginning of a tangent curve concave Southerly and having a radius of 3000.00'.

Thence Easterly along said curve through a central angle of 01 Degrees 24'38" a distance of 73.86'.

Thence tangent from said curve North 81 Degrees 39'22" East a distance of 2497.32' to the beginning of a tangent curve concave Northwesterly and having a radius of 4200.00'.

Thence Easterly along said curve Through a central angle of 10 Degrees 54'22" a distance of 799.46'.

Thence tangent from said curve North 70 Degrees 45'00" East a distance of 51147.52' to the beginning of a tangent curve concave Southerly and having a radius of 4200.00'.

Thence Northeasterly along said curve through a central angle of 17 Degrees 00'24" a distance of 1246.29'.

Thence tangent from said curve North 87 Degrees 45'06" East a distance of 1635.73' to the beginning of a curve concave Northwesterly and having a radius of 6250.00'.

Thence Easterly along said curve through a central angle of 36 Degrees 39'21" a distance of 3998.53'.

Thence tangent from said curve North 51 Degrees 05'45" East a distance of 2355.02' to the beginning of a tangent curve concave Southeasterly and having a radius of 10540.00'.

Thence Easterly along said curve through a central angle of 15 Degrees 30'13" a distance of 2852.04'.

Thence South 20 Degrees 58'19" East a distance of 325.30' to the beginning of a non-tangent curve concave Southerly and having a radius of 3000.00'. A radial line bears North 23 Degrees 23'40" West.

Thence Southerly along said curve through a central angle of 57 Degrees 07'25" a distance of 2991.74'.

Thence South 86 Degrees 39'42" East a distance of 284.32'.

Thence South 46 Degrees 49'32" East a distance of 555.37'.

Thence South 38 Degrees 39'35" East a distance of 224.11'.

Thence South 51 Degrees 24'55" East a distance of 185.07'.

Thence South 80 Degrees 50'16" East a distance of 157.00'.

Thence North 88 Degrees 31'25" East a distance of 194.06'.

Thence North 62 Degrees 25'22" East a distance of 632.91'.

Thence North 38 Degrees 17'25" East a distance of 435.73'.

Thence North 22 Degrees 28'46" East a distance of 156.92'

Thence North 40 Degrees 01'49" East a distance of 163.25'.

Thence South 65 Degrees 57'21" East a distance of 142.35'.

Thence North 10 Degrees 10'09" East a distance of 226.56'.

Thence North 61 Degrees 41'57" East a distance of 295.30'.

Thence North 88 Degrees 27'06" East a distance of 185.07'.

Thence South 66 Degrees 48'05" East a distance of 228.47'.

Thence South 15 Degrees 27'30" East a distance of 420.20'.

Thence South 29 Degrees 10'58" East a distance of 303.53'.

Thence South 43 Degrees 59'42" East a distance of 201.56'.

Thence South 56 Degrees 18'36" East a distance of 246.33'.

Thence South 78 Degrees 06'41" East a distance of 97.08'.

Thence South 01 Degrees 58'03" East a distance of 145.09'.

Thence South 25 Degrees 13'16" East a distance of 152.54'.

Thence North 27 Degrees 26'06" East a distance of 206.19'.

Thence South 49 Degrees 53'57" East a distance of 248.39'.

Thence North 87 Degrees 03'51" East a distance of 390.51'.

Thence North 68 Degrees 38'01" East a distance of 397.40'.

Thence North 56 Degrees 46'06" East a distance of 173.35'.

Thence North 62 Degrees 06'10" East a distance of 288.53'.

Thence North 53 Degrees 23'34" East a distance of 218.00'.

Thence South 04 Degrees 23'55" West a distance of 130.38".

Thence South 26 Degrees 33'54" West a distance of 368.95'.

Thence South 36 Degrees 09'30" West a distance of 322.02'.

Thence South 27 Degrees 19'26" West a distance of 337.68'.

Thence South 22 Degrees 30'46" West a distance of 445.19' to the beginning of a tangent curve concave Northeasterly and having a radius of 250.00'.

Thence Southeasterly along said curve through a central angle of 112 Degrees 58'16" a distance of 492.93'.

Thence tangent to said curve Nroth 89 Degrees 32'30" East a distance of 247.52'.

Thence South 81 Degrees 07'09" East a distance of 161.94'.

Thence South 13 Degrees 14'26" West a distance of 87.32'.

Thence South 73 Degrees 14'15" East a distance of 86.68'.

Thence North 19 Degrees 17'24" East a distance of 127.14'.

Thence North 77 Degrees 49'43" East a distance of 260.86'.

Thence South 85 Degrees 41'60" East a distance of 133.38'.

Thence North 62 Degrees 51'01" East a distance of 131.49'.

Thence North 78 Degrees 41'24" East a distance of 127.48'

Thence South 69 Degrees 26'38" East a distance of 128.16'.

Thence South 42 Degrees 46'03" East a distance of 544.89'.

Thence North 25 Degrees 38'28" East a distance of 544.89'.

Thence South 49 Degrees 53'57" East a distance of 248.39'.

Thence South 17 Degrees 06'10" East a distance of 136.01'.

Thence North 11 Degrees 04'13" East a distance of 234.36'.

Thence South 86 Degrees 54'21" East a distance of 185.27'.

Thence South 09 Degrees 51'57" East a distance of 116.73'.

Thence North 46 Degrees 32'54" East a distance of 130.86'.

Thence North 82 Degrees 114'05" East a distance of 111.02'.

Thence South 71 Degrees 33'54" East a distance of 110.68'.

Thence South 20 Degrees 11'39" East a distance of 92.70'.

Thence South 00 Degrees 58'16" West a distance of 118.02'.

Thence South 17 Degrees 44'41" West a distance of 131.24'.

Thence North 71 Degrees 04'31" East a distance of 185.00'.

Thence North 23 Degrees 11'55" East a distance of 190.39'.

Thence South 75 Degrees 57'50" East a distance of 103.08'.

Thence South 23 Degrees 57'45" East a distance of 147.73'.

Thence South 33 Degrees 18'38" East a distance of 209.40'.

Thence North 58 Degrees 14'26" East a distance of 123.49'.

Thence South 72 Degrees 05'22" East a distance of 276.39'.

Thence South 06 Degrees 52'54" West a distance of 292.10'.

Thence South 22 Degrees 39'34" West a distance of 111.62'.

Thence South 44 Degrees 20'02" West a distance of 121.63'.

Thence South 16 Degrees 14'20" East a distance of 107.28'.

Thence South 06 Degrees 28'59" West a distance of 132.85'.

Thence South 38 Degrees 13'13" West a distance of 101.83'.

Thence South 02 Degrees 07'16" East a distance of 270.19'.

Thence South 34 Degrees 31'41" West a distance of 303.45'.

Thence South 29 Degrees 21'28" West a distance of 91.79'.

Thence South 11 Degrees 33'36" East a distance of 224.56'.

Thence South 04 Degrees 05'08" West a distance of 140.36'.

Thence South 41 Degrees 11'09" West a distance of 106.30'.

Thence South 11 Degrees 46'06" West a distance of 122.58'.

Thence South 23 Degrees 11'55" West a distance of 114.24'.

Thence South 53 Degrees 07'48" West a distance of 125.00'.

Thence South 38 Degrees 59'28" West a distance of 96.30' to the beginning of a tangent curve concave Northwesterly and having a radius of 325.00'.

Thence Westerly along said curve through a central angle of 56 Degrees 17'56" a distance of 319.35'.

Thence tangent to said curve North 84 Degrees 42'36" West a distance of 97.26'.

Thence South 78 Degrees 53'13" West a distance of 130.45' to the beginning of a tangent curve concave Southeasterly and having a radius of 75.00'.

Thence Southerly along said curve through a central angle of 128 Degrees 19'41" a distance of 167.98'.

Thence tangent to said curve South 49 Degrees 26'28" East a distance of 137.31'.

Thence South 86 Degrees 33'09" East a distance of 83.15'.

Thence South 31 Degrees 13'35" West a distance of 187.11'.

Thence North 82 Degrees 14'05" East a distance of 111.02'.

Thence South 36 Degrees 42'10" West a distance of 205.80'.

Thence South 78 Degrees 115'57" West a distance of 255.34 to the beginning of a tangent curve concave Easterly and having a distance of 30.00'.

Thence Southerly along said curve through a central angle of 142 Degrees 41'04" a distance of 74.71'.

Thence tangent to said curve South 64 Degrees 25'07" East a distance of 223.80'.

Thence South 59 Degrees 02'10" East a distancee of 145.77'.

Thence South 39 Degrees 02'08" East a distance of 238.17'.

Thence West a distance of 170.00'.

Thence South 25 Degrees 12'04" East a distance of 187.88'.

Thence South 36 Degrees 52'12" East a distance of 102.01' to the beginning of a tangent curve concave Westerly and having a radius of 95.00'.

Thence Southerly along said curve through a central angle of 91 Degrees 46'27" a distance of 152.17'.

Thence tangent to said curve South 54 Degrees 54'15" West a distance of 128.12'.

Thence South 68 Degrees 27'32" West a distance of 204.27'.

Thence South 41 Degrees 11'09" West a distance of 106.30'.

Thence South 81 Degrees 01'39" West a distance of 96.28'.

Thence South 03 Degrees 00'46" East a distance of 95.13'.

Thence South 39 Degrees 59'13" West a distance of 202.30'.

Thence South 07 Degrees 07'30" East a distance of 241.87'.

Thence South 55 Degrees 29'29" West a distance of 291.25'.

Thence South 77 Degrees 04'26" West a distance of 120.28' to the beginning of a tangent curve concave Southeasterly and having a radius of 300.00'.

Thence Westerly along said curve through a central angle of 65 Degrees 24'53" a distance of 342.51'.

Thence North 65 Degrees 00'00" East a distance of 125.00'.

Thence North 55 Degrees 00'29" East a distance of 122.07'.

Thence North 72 Degrees 53'50" East a distance of 204.02'.

Thence North 81 Degrees 42'51" East a distance of 416.35'.

Thence East a distance of 50.00'.

Thence North 19 Degrees 39'14" West a distance of 193.26'.

Thence North 39 Degrees 48'20" East a distance of 101.53'.

Thence North 17 Degrees 39'00" East 115.43'.

Thence North 32 Degrees 32'30" East 124.56'.

Thence North 47 Degrees 24'48" East a distance of 184.72'.

Thence South 04 Degrees 21'25" West a distance of 105.30'.

Thence South 30 Degrees 52'00" East a distance of 101.36'.

Thence South 47 Degrees 45'22" East a distance of 145.78'.

Thence North 55 Degrees 26'15" East a distance of 109.29'.

Thence South 89 Degrees 27'16" East a distance of 210.01'.

Thence South 27 Degrees 12'58" East a distance of 393.57'.

Thence South 33 Degrees 41'24" East a distance of 108.17'.

Thence South 66 Degrees 48'05" East a distance of 114.24'.

Thence South 27 Degrees 17'58" East a distance of 174.43'.

Thence North 16 Degrees 41'57" East a distance of 104.40'.

Thence North 74 Degrees 49'38" East a distance of 183.39'.

Thence South 74 Degrees 11'51" East a distance of 110.16'.

Thence North 10 Degrees 18'17" East a distance of 134.16'.

Thence South 86 Degrees 11'09" West a distance of 120.27'.

Thence South 76 Degrees 33'05" West a distance of 94.59'.

Thence North 66 Degrees 22'14" West a distance of 174.64'.

Thence North 43 Degrees 34'04" West a distance of 113.17'.

Thence North 00 Degrees 46'27" West a distance of 148.01'.

Thence East a distance of 110.00'.

Thence North 73 Degrees 47'28" East a distance of 83.84' to the beginning of a tangent curve concave Northwesterly and having a radius of 180.00'.

Thence Easterly along said curve through a central angle of 55 Degrees 47'13" a distance of 175.26'.

Thence tangent to said curve North 18 Degrees 00'15" East 157.08'.

Thence East a distance of 130.00'.

Thence North 06 Degrees 37'57" West a distance of 173.16'.

Thence North 66 Degrees 25'31" West a distance of 120.02'.

Thence North 24 Degrees 05'15" West a distance of 93.11'.

Thence North 40 Degrees 47'41" East a distance of 96.43'.
Thence North 01 Degrees 28'08" West a distance of 117.04'.

Thence North 75 Degrees 41'20" East a distance of 101.14'.

Thence North 34 Degrees 59'31" West a distance of 122.07'.

Thence South 87 Degrees 16'25" East a distance of 210.24'.

Thence North 15 Degrees 51'22" West a distance of 277.22'.

Thence North 15 Degrees 56'43" West a distance of 109.20'.

Thence North 19 Degrees 08'01" West a distance of 259.33'.

Thence South 87 Degrees 47'51" East a distance of 130.10'.

Thence South 68 Degrees 11'55" East a distance of 107.70'.

Thence South 51 Degrees 20'25" East a distance of 192.09'.

Thence North 13 Degrees 12'04" West a distance of 166.40'.

Thence South 80 Degrees 45'52" East a distance of 124.62'.

Thence North 33 Degrees 10'43" West a distance of 155.32'.

Thence North 53 Degrees 15'09" East a distance of 93.60'.

Thence North 85 Degrees 06'03" East a distance of 140.51'.

Thence South 72 Degrees 53'50" East a distance of 136.02'.

Thence North 76 Degrees 51'10" East a distance of 140.69'.

Thence North 80 Degrees 52'11" West a distance of 113.44'.

Thence North 52 Degrees 07'30" West a distance of 114.02'.

Thence North 76 Degrees 45'34" West a distance of 174.64'.

Thence South 86 Degrees 03'17" West a distance of 145.34'.

Thence North 40 Degrees 54'52" East a distance of 99.25'.

Thence North 50 Degrees 11'40" East a distance of 195.26'.

Thence North 03 Degrees 10'47" East a distance of 90.14'.

Thence North 48 Degrees 07'20" East a distance of 194.74'.

Thence South 79 Degrees 02'45" East a distance of 157.88'.

Thence North 14 Degrees 51'01" West a distance of 136.56'.

Thence North 83 Degrees 22'45" East a distance of 112.75'.

Thence North 25 Degrees 10'25" West a distance of 110.49'.

Thence North 36 Degrees 28'09" West a distance of 143.00'.

Thence North 57 Degrees 59'41" East a distance of 94.34'.

Thence North 29 Degrees 03'17" East a distance of 102.96'.

Thence North 59 Degrees 02'10" West a distance of 87.46'

Thence North 01 Degrees 47'24" East a distance of 160.08'.

Thence North 14 Degrees 11'37" West a distance of 265.09'.

Thence North 22 Degrees 55'56" West a distance of 141.16'.

Thence North 03 Degrees 24'23" West a distance of 168.30'.

Thence South 67 Degrees 54'46" East a distance of 372.32'.

Thence South 80 Degrees 13'03" East a distance of 176.57'.

Thence South 42 Degrees 17'14" East a distance of 283.87'.

Thence South 41 Degrees 49'13" West a distance of 127.48'.

Thence South 30 Degrees 22'45" West a distance of 168.08'.

Thence South 65 Degrees 39'32" West a distance of 230.49'.

Thence South 79 Degrees 27'58" East a distance of 246.15'.

Thence South 20 Degrees 28'20" East a distance of 80.06'

Thence South 27 Degrees 00'46" West a distance of 286.23'.

Thence South 11 Degrees 53'19" West a distance of 194.16'.

Thence South 03 Degrees 21'59" East a distance of 170.29'.

Thence South 28 Degrees 26'34" East a distance of 272.95'.

Thence South 05 Degrees 48'24" East a distance of 296.52'.

Thence South 39 Degrees 28'21" East a distance of 110.11'.

Thence South 71 Degrees 33'54" East a distance of 94.87'.

Thence South 04 Degrees 23'55" East a distance of 130.38'.

Thence South 21 Degrees 20'13" East a distance of 343.55'.

Thence North 43 Degrees 31'52" East a distance of 137.93'.

Thence South 62 Degrees 14'29" East a distance of 107.35'.

Thence South 14 Degrees 02'10" East a distance of 144.31'.

Thence South 26 Degrees 33'54" East a distance of 122.98'.

Thence North 19 Degrees 39'14" East a distance of 222.99'.

Thence South 80 Degrees 32'16" East a distance of 91.24'.

Thence South 23 Degrees 52'06" East a distance of 123.57'.

Thence North 49 Degrees 23'55" East a distance of 92.20'.

Thence South 85 Degrees 06'03" East a distance of 140.51'.

Thence South 02 Degrees 43'35" West a distance of 105.12'.

Thence North 59 Degrees 32'04" East a distance of 98.62'.

Thence South 56 Degrees 18'36" East a distance of 90.14'.

Thence North 87 Degrees 42'34" East a distance of 125.10'.

Thence North 80 Degrees 04'26" East a distance of 203.04'.

Thence North 74 Degrees 21'28" East a distance of 129.81'.

Thence South 33 Degrees 16'30" East a distance of 191.38'.

Thence South 31 Degrees 25'47" West a distance of 105.48'.

Thence South 08 Degrees 52'51" West a distance of 129.55'.

Thence North 73 Degrees 18'03" East a distance of 167.04'.

Thence South 01 Degrees 35'28" East a distance of 180.07'.

Thence South 17 Degrees 01'14" West a distance of 102.49'.

Thence South 80 Degrees 44'39" East a distance of 136.78'.

Thence South 19 Degrees 42'51" West a distance of 127.47'.

Thence South 61 Degrees 36'25" West a distance of 252.36'.

Thence North 79 Degrees 37'27" East a distance of 228.72' to the beginning of a tangent curve concave Southwesterly and having a radius of 80.00'.

Thence Southerly along said curve through a central angle of 117 Degrees 37'57" a distance of 164.25'.

Thence tangent to said curve South 17 Degrees 15'24" West a distance of 113.90'.

Thence North 67 Degrees 02'10" East a distance of 128.16'.

Thence South 11 Degrees 46'06" West a distance of 122.58'.

Thence South 72 Degrees 38'46" West a distance of 167.63'.

Thence South 67 Degrees 53'26" East a distance of 172.70'.

Thence South 21 Degrees 02'15" East a distance of 139.28'.

Thence South 46 Degrees 50'51" West a distance of 109.66'.

Thence South 69 Degrees 08'44" East a distance of 112.36'.

Thence North 38 Degrees 17'25" East a distance of 242.07'.

Thence South 43 Degrees 52'36" East a distance of 180.35'.

Thence North 41 Degrees 59'14" East a distance of 134.54'.

Thence South 49 Degrees 14'11" East a distance of 191.44'.

Thence South 03 Degrees 41'29" West a distance of 155.32'.

Thence South 26 Degrees 33'54" West a distance of 111.80'.

Thence South 03 Degrees 34'35" East a distance of 160.31'.

Thence North 50 Degrees 37'51" East a distance of 252.24'.

Thence South 74 Degrees 03'17" East a distance of 109.20'.

Thence North 27 Degrees 33'10" East a distance of 103.77'.

Thence North 32 Degrees 44'07" West a distance of 199.72'.

Thence North 26 Degrees 33'54" East a distance of 100.62'.

Thence North 88 Degrees 21'48" East a distance of 105.04'.

Thence North 72 Degrees 04'56" East a distance of 315.29'.

Thence South 60 Degrees 15'18" East a distance of 161.25'.

Thence East a distance of 72.00'.

Thence South 20 Degrees 15'57" East a distance of 138.58'.

Thence South 33 Degrees 10'43" West a distance of 155.32'.

Thence North 87 Degrees 36'51" East a distance of 120.10'.

Thence South 05 Degrees 54'22" West a distance of 145.77'.

Thence South 30 Degrees 15'23" West a distance of 138.92'.

Thence South 04 Degrees 45'49" East a distance of 120.42'.

Thence South 15 Degrees 25'20" West a distance of 150.42'.

Thence South a distance of 235.00'.

Thence South 06 Degrees 34'55" East a distance of 130.86'.

Thence South 08 Degrees 58'21" West a distance of 192.35'.

Thence South 51 Degrees 48'33" East a distance of 95.43'.

Thence South 28 Degrees 47'12" West a distance of 103.83'.

Thence South 14 Degrees 02'10" East a distance of 103.08'.

Thence South 05 Degrees 11'40" West a distance of 165.68'.

Thence South 22 Degrees 50'01" East a distance of 103.08'.

Thence South 61 Degrees 11'21" West a distance of 114.13'.

Thence South 71 Degrees 33'54" East a distance of 126.49'.

Thence South 05 Degrees 26'25" East a distance of 105.48'.

Thence South 46 Degrees 32'54" East a distance of 130.86'.

Thence South 41 Degrees 20'52" East a distance of 133.21'.

Thence South 50 Degrees 49'15" East a distance of 292.84'.

Thence South 10 Degrees 00'29" East a distance of 86.31'.

Thence South 45 Degrees 00'00" East a distance of 205.06'.

Thence South a distance of 130.00'.

Thence North 86 Degrees 25'25" East a distance of 320.62'.

Thence South 60 Degrees 01'06" East a distance of 150.08'.

Thence South 24 Degrees 26'38" East a distance of 120.83'.

Thence South 49 Degrees 41'09" East a distance of 216.39'.

Thence North 55 Degrees 42'47" East a distance of 266.27'.

Thence North 62 Degrees 02'56" East a distance of 277.35'.

Thence North 72 Degrees 21'00" East a distance of 230.87'.

Thence North 59 Degrees 02'10" East a distance of 204.08'.

Thence North 77 Degrees 00'19" East a distance of 133.42'.

Thence North 47 Degrees 07'16" East a distance of 95.52'.

Thence North 24 Degrees 13'40" East a distance of 109.66'.

Thence North 43 Degrees 09'09" East a distance of 219.32'.

Thence North 55 Degrees 00'29" East a distance of 122.07'.

Thence North 49 Degrees 11'06" West a distance of 145.34'.

Thence North 68 Degrees 37'46" East a distance of 123.49'.

Thence North 82 Degrees 41'39" East a distance of 196.60'.

Thence South 63 Degrees 26'06" East a distance of 212.43'.

Thence South 49 Degrees 23'55" East a distance of 92.20'.

Thence South 71 Degrees 50'02" East a distance of 336.79'.

Thence South 43 Degrees 15'51" East a distance of 233.45'.

Thence South 47 Degrees 01'17" East a distance of 300.71'.

Thence South 42 Degrees 11'04" East a distance of 215.93'.

Thence South 48 Degrees 53'16" East a distance of 365.00'.

Thence South 47 Degrees 47'51" East a distance of 280.00'.

Thence South 71 Degrees 42'59" East a distance of 500.00' to the beginning of a tangent curve concave Southwesterly and having a radius of 2500.00'.

Thence Easterly along said curve through a central angle of 17 Degrees 31'51" to a point on the East boundary line of The Pauba Rancho.

Thence Southwesterly along said rancho boundary line to the most Southeasterly corner thereof.

Thence Westerly along said rancho boundary line to the Northwest corner of Section 24, Township 8 South, Range 1 West.

Thence Southerly along the West line of said Section 24 to the Southwest corner thereof.

Thence Easterly along the South line of said Section 24 to the Southeast corner thereof.

Thence Southerly along the West line of Section 30, Township 8 South, Range 1 East to the Southwest corner thereof.

Thence Easterly along the South line of said Section 30 and the South line of Section 29, Township 8 South, Range 1 East to the Southeast corner thereof.

Thence Southerly along the West line of Section 33, Township 8 South, Range 1 East to the Southwest corner thereof. Said corner also being a point in the Southerly boundary line of the County of Riverside, California.

Thence Easterly along said Southerly boundary line to its intersection with the East line of Section 35, Township 8 South, Range 1 East.

Thence Northerly along the East line of said Section 35 to the Northeast corner thereof.

Thence Westerly along the North line of said Section 35 to the Northwest corner thereof.

Thence Northerly along the East line of Sections 27 and 22, Township 8 South, Range 1 East to the Northeast corner thereof.

Thence Easterly along the South line of the West 1/2 and the West 1/2 of the East 1/2 of Section 14, Township 8 South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of the West 1/2 of the East 1/2 of said Section 14 to the Northeast corner thereof.

Thence Westerly along the North line of said Section 14 and the North line of Section 15, Township 8 South, Range 1 East to the Northwest corner thereof.

Thence Southerly along the West line of said Section 15 and the West line of Section 22, Township 8 South, Range 1 East to the Southwest corner thereof.

Thence Westerly along the North line of Sections 28 and 29, Township 8 South, Range 1 East to the Northwest corner thereof.

Thence Northerly along the East line of Section 19, Township 8 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of said Section 19 to the Northwest corner thereof.

Thence Northerly alogn the East line of Section 13, Township 8 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of said Section 13 to its intersection with the Easterly boundary line of the Pauba Rancho.

Thence Southwesterly along said rancho boundary line a distance of 3800.00'.

Thence leaving said rancho boundary line South 77 Degrees 12'23" West a distance of 1542.24' to the beginning of a non-tangent curve concave Northeasterly and having a radius of 600.00'. A radial line bears North 03 Degrees 16'45" East.

Thence Westerly along said curve through a central angle of 35 Degrees 39'40" a distance of 373.44'.

Thence leaving said curve North 33 Degrees 45'20" East a distance of 484.24'.

Thence North 47 Degrees 46'03" East a distance of 700.84'.

Thence North 54 Degrees 32'56" East a distance of 152.89'.

Thence North 82 Degrees 13'56" East a distance of 187.36'.

Thence North 87 Degrees 54'05" East a distance of 390.53'.

Thence North 78 Degrees 01'53" East a distance of 201.31'.

Thence South 80 Degrees 36'13" East a distance of 353.91' to a point on the Easterly boundary line of The Pauba Rancho.

Thence along said rancho boundary line North 13 Degrees 35'32" East a distance of 224.85'.

Thence North 80 Degrees 21'04" West a distance of 630.44'.

Thence South 87 Degrees 33'13" West a distance of 511.46'.

Thence South 72 Degrees 43'11" West a distance of 184.78'.

Thence South 59 Degrees 31'31" West a distance of 429.17'.

Thence South 67 Degrees 09'37" West a distance of 577.07'.

Thence South 29 Degrees 09'59" West a distance of 480.00'.

Thence South 46 Degrees 38'12" West a distance of 123.79'.

Thence North 85 Degrees 01'49" West a distance of 230.87'.

Thence North 55 Degrees 48'50" West a distance of 120.00'.

Thence North 19 Degrees 42'53" East a distance of 191.37'.

Thence North 39 Degrees 18'41" East a distance of 406.86'.

Thence North 41 Degrees 53'28" East a distance of 609.71'.

Thence North 37 Degrees 14'26" East a distance of 60.83'.

Thence North 52 Degrees 27'24" West a distance of 80.09'.

Thence South 60 Degrees 33'10" West a distance of 553.62'.

Thence South 37 Degrees 53'43" West a distance of 800.00'.

Thence South 54 Degrees 41'20" West a distance of 147.05'.

Thence West a distance of 160.00'.

Thence South 78 Degrees 31'05" West a distance of 326.53'.

Thence South 72 Degrees 33'10" West a distance of 183.44'.

Thence North 59 Degrees 32'04" West a distance of 98.62'.

Thence South 80 Degrees 32'16" West a distance of 121.66'.

Thence North 78 Degrees 13'54" West a distance of 122.58'.

Thence North 60 Degrees 15'18" West a distance of 161.25'.

Thence North 34 Degrees 17'13" West a distance of 133.14'.

Thence North 12 Degrees 05'41" East a distance of 143.18'.

Thence North 79 Degrees 00'41" West a distance of 104.92'.

Thence North 11 Degrees 18'36" West a distance of 112.18'.

Thence North 21 Degrees 48'05" West a distance of 107.70'.

Thence North 08 Degrees 07'48" West a distance of 282.84'.

Thence North 70 Degrees 33'36" East a distance of 90.14'.

Thence North 49 Degrees 45'49" West a distance of 170.29'.

Thence North 15 Degrees 22'35" West a distance of 207.42'.

Thence North 51 Degrees 50'34" East a distance of 178.04'.

Thence South 58 Degrees 23'13" East a distance of 152.64'.

Thence South 85 Degrees 36'05" East a distance of 130.38'.

Thence North 45 Degrees 00'00" West a distance of 169.71'.

Thence North 40 Degrees 36'05" East a distance of 92.20'.

Thence North 59 Degrees 20'57" West a distance of 156.92'.

Thence South 83 Degrees 39'35" East a distance of 90.55'.

Thence North 70 Degrees 20'46" West a distance of 148.66'.

Thence South 34 Degrees 22'49" West a distance of 115.11'.

Thence South 54 Degrees 09'44" West a distance of 111.02'.

Thence North 69 Degrees 08'44" West a distance of 112.36'.

Thence North 39 Degrees 24'03" East a distance of 362.35'.

Thence South 70 Degrees 01'01" West a distance of 117.05'.

Thence South 54 Degrees 14'46" West a distance of 154.03'.

Thence North 34 Degrees 59'31" West a distance of 122.07'.

Thence North 09 Degrees 39'36" East a distance of 238.38'.

Thence North 77 Degrees 35'33" East a distance of 255.98'.

Thence North 35 Degrees 32'16" West a distance of 86.02'.

Thence North 55 Degrees 42'47" East a distance of 266.27'.

Thence North 87 Degrees 08'15" East a distance of 200.25'.

Thence North 63 Degrees 26'06" East a distance of 223.61'.

Thence South 86 Degrees 59'14" West a distance of 190.26'.

Thence North 74 Degrees 28'33" West a distance of 280.22'.

Thence North 11 Degrees 53'19" West a distance of 97.08'.

Thence South 15 Degrees 49'09" West a distance of 187.09'.

Thence South 67 Degrees 22'48" West 130.00'.

Thence South 61 Degrees 23'22" West a distance of 125.30'.

Thence North 06 Degrees 06'56" East a distance of 140.80'.

Thence North 07 Degrees 07'30" West a distance of 120.93'.

Thence South 29 Degrees 03'17" West a distance of 102.96'.

Thence South 68 Degrees 11'55" West a distance of 107.70'.

Thence North 20 Degrees 00'15" East a distance of 149.03'.

Thence North 13 Degrees 11'26" East a distance of 328.67'.

Thence North 00 Degrees 40'56" West a distance of 420.00'.

Thence North 50 Degrees 42'38" West a distance of 142.13'.

Thence North 22 Degrees 50'01" West a distance of 103.08'.

Thence North 43 Degrees 01'30" West a distance of 102.59'.

Thence North 21 Degrees 48'05" West a distance of 107.70'.

Thence North 47 Degrees 36'09" West a distance of 155.72'.

Thence North 77 Degrees 28'16" West a distance of 58.37' to the beginning of a tangent curve concave Northeasterly and having a radius of 125.00'.

Thence Northerly along said curve through a central angle of 90 Degrees 27'57" a distance of 197.37'.

Thence tangent to said curve North 12 Degrees 59'41" East a distance of 74.10'.

Thence North 85 Degrees 14'10" East a distance of 120.42'.

Thence South 79 Degrees 06'52" East a distance of 132.38'.

Thence East a distance of 120.00'.

Thence North 77 Degrees 28'16" East a distance of 507.70'.

Thence South 88 Degrees 05'27" East a distance of 300.17'.

Thence South 51 Degrees 20'25" East a distance of 96.05'.

Thence North 81 Degrees 24'59" East a distance of 268.00'.

Thence North 52 Degrees 07'30" West a distance of 171.03'.

Thence North 31 Degrees 15'49" East a distance of 163.78'.

Thence North 52 Degrees 48'55" East a distance of 182.00'.

Thence North 41 Degrees 49'13" East a distance of 127.48'.

Thence North 27 Degrees 17'59" East a distance of 174.43'.

Thence North 43 Degrees 36'10" East a distance of 145.00'.

Thence North 72 Degrees 07'17" East a distance of 162.86'.

Thence North 51 Degrees 50'34" West a distance of 89.02'.

Thence North 05 Degrees 11'40" East a distance of 110.45'.

Thence North 15 Degrees 04'07" East a distance of 134.63'.

Thence North 72 Degrees 28'28" East a distance of 99.62'.

Thence North 54 Degrees 27'44" West a distance of 86.02'.

Thence North 11 Degrees 00'13" West a distance of 183.37'.

Thence North 79 Degrees 54'29" East a distance of 228.54'.

Thence South 68 Degrees 33'08" East a distance of 150.42'.

Thence North 03 Degrees 56'43" East a distance of 145.34'.

Thence North 56 Degrees 18'36" East a distance of 144.22'.

Thence South 37 Degrees 18'14" East a distance of 132.00'.

Thence South 46 Degrees 07'24" East a distance of 180.35'.

Thence South 47 Degrees 38'33" East a distance of 230.05'.

Thence North 03 Degrees 21'59" East a distance of 85.15'.

Thence North 17 Degrees 21'14" East a distance of 83.82'.

Thence North 22 Degrees 46'57" West a distance of 271.15'.

Thence North 61 Degrees 41'57" East a distance of 147.65'.

Thence South 21 Degrees 58'28" East a distance of 196.17' to the beginning of a tangent curve concave Northeasterly and having a radius of 120.00'.

Thence Easterly along said curve through a central angle of 85 Degrees 37'05" a distance of 179.32'.

Thence tangent to said curve North 72 Degrees 24'27" East a distance of 103.90'.

Thence North 56 Degrees 18'36" East a distance of 90.14'.

Thence South 58 Degrees 40'17" East a distance of 134.63'.

Thence South 39 Degrees 17'22" East a distance of 142.13'.

Thence North 10 Degrees 07'29" East a distance of 142.21'.

Thence North 08 Degrees 21'57" West a distance of 171.83'.

Thence North 36 Degrees 15'14" West a distance of 186.01'.

Thence North 59 Degrees 32'04" East a distance of 98.62'.

Thence North 82 Degrees 05'34" East a distance of 181.73'.

Thence North 65 Degrees 43'32" East a distance of 279.73'.

Thence North 46 Degrees 23'50" East a distance of 145.00'.

Thence North 35 Degrees 50'16" East a distance of 111.02'.

Thence North 59 Degrees 02'10" East a distance of 204.08'.

Thence North 35 Degrees 45'14" East a distance of 154.03'.

Thence North 55 Degrees 55'22" East a distance of 205.24'.

Thence North 75 Degrees 46'26" East a distance of 366.23'.

Thence North 68 Degrees 11'55" East a distance of 188.48'.

Thence North 74 Degrees 57'44" East a distance of 346.88'.

Thence North 66 Degrees 15'02" East a distance of 136.57'.

Thence North 30 Degrees 34'45" East a distance of 127.77'.

Thence North 11 Degrees 58'34" West a distance of 168.67'.

Thence South 60 Degrees 38'32" East a distance of 91.79'.

Thence South 34 Degrees 59'31" East a distance of 122.07'.

Thence South 41 Degrees 38'01" East a distance of 120.42'
.
Thence North 12 Degrees 31'44" West a distance of 92.20'.

Thence South 81 Degrees 28'09" East a distance of 101.12'.

Thence North 67 Degrees 50'01" West a distance of 145.77'.

Thence South 75 Degrees 59'45" East a distance of 915.00' to a point on the Easterly boundary line of The Pauba Rancho.

Thence along said rancho boundary line North 13 Degrees 35'32" East a distance of 655.26'.

Thence leaving said rancho boundary line North 44 Degrees 20'36" West a distance of 114.98' to the beginning of a tangent curve concave Easterly and having a radius of 150.00'.

Thence Northerly along said curve through a central angle of 105 Degrees 00'00 a distance of 274.89'.

Thence tangent from said curve North 60 Degrees 39'24" East a distance of 150.00'.

Thence North 06 Degrees 50'36" West a distance of 92.39'.

Thence North 74 Degrees 20'36" West a distance of 300.00'.

Thence North 70 Degrees 45'43" West a distance of 491.69'.

Thence North 48 Degrees 04'02" West a distance of 505.79'.

Thence North 18 Degrees 21'47" East a distance of 458.89'.

Thence South 87 Degrees 10'09" West a distance of 1250.40'.

Thence South 08 Degrees 12'01" West a distance of 385.08'.

Thence South 27 Degrees 12'07" East a distance of 223.45'.

Thence South 13 Degrees 42'18" West a distance of 120.01'.

Thence South 77 Degrees 25'51" West a distance of 631.86'.

Thence North 45 Degrees 05'45" West a distance of 178.80'.

Thence North 23 Degrees 39'02" West a distance of 724.70'.

Thence North 34 Degrees 49'03" West a distance of 211.87'.

Thence North 62 Degrees 41'17" West a distance of 254.81.'

Thence North 86 Degrees 37'15" West a distance of 334.80'.

Thence South 66 Degrees 05'48" West a distance of 261.74'.

Thence South 67 Degrees 10'15" West a distance of 293.59'.

Thence South 85 Degrees 01'36" West a distance of 375.77'.

Thence North 85 Degrees 49'14" West a distance of 446.34'.

Thence North 57 Degrees 51'27" West a distance of 292.38'.

Thence North 29 Degrees 42'26" West a distance of 214.87'.

Thence North 07 Degrees 53'17" East a distance of 210.39'.

Thence North 35 Degrees 38'42" East a distance of 394.07'.

Thence North 86 Degrees 55'06" West a distance of 417.69'.

Thence South 43 Degrees 16'41" West a distance of 211.99'.

Thence South 15 Degrees 17'49" West a distance of 573.11'.

Thence South 41 Degrees 49'02" West a distance of 255.56'.

Thence South 38 Degrees 27'42" East a distance of 391.47'.

Thence South 13 Degrees 21'05" East a distance of 767.66'.

Thence South 14 Degrees 02'10" East a distance of 176.87' to the beginning of a tangent curve concave Westerly and having a radius of 140.00'.

Thence Southerly along said curve through a central angle of 39 Degrees 14'14" a distance of 95.88'.

Thence tangent to said curve South 25 Degrees 12'04" West a distance of 17.44' to the beginning of a tangent curve concave Northerly and having a radius of 50.00'.

Thence Westerly along said curve through a central angle of 134 Degrees 56'37" a distance of 117.76'.

Thence tangent to said curve North 19 Degrees 51'19" West a distance of 70.84'.

Thence West a distance of 80.00'.

Thence South a distance of 130.00'.

Thence North 70 Degrees 01'01" West a distance of 117.05'.

Thence South 22 Degrees 14'56" West a distance of 118.85'.

Thence South 62 Degrees 06'10" East a distance of 96.18'.

Thence South 16 Degrees 18'50" West a distance of 213.60'.

Thence South 72 Degrees 28'28" West a distance of 99.62'.

Thence North 48 Degrees 48'51" West a distance of 106.30'.

Thence South 41 Degrees 11'09" West a distance of 159.45'.

Thence North 23 Degrees 57'45" West a distance of 98.49'.

Thence South 71 Degrees 33'54" West a distance of 94.87'.

Thence North 53 Degrees 36'56" West a distance of 118.00'.

Thence North 23 Degrees 25'43" East a distance of 163.48'.

Thence North 06 Degrees 20'25" West a distance of 90.55'.

Thence North 23 Degrees 11'55" East a distance of 76.16'.

Thence South 48 Degrees 48'51" West a distance of 106.30'.

Thence South 33 Degrees 41'24" West a distance of 108.17'.

Thence South 48 Degrees 10'47" West a distance of 127.48'.

Thence North 12 Degrees 31'44" West a distance of 138.29'.

Thence South 82 Degrees 24'19" West a distance of 75.66'.

Thence North 11 Degrees 18'36" West a distance of 50.99'.

Thence North 71 Degrees 33'54" West a distance of 63.25'.

Thence North 08 Degrees 07'48" West a distance of 70.71'.

Thence South 75 Degrees 04'07" West a distance of 155.24'.

Thence North 81 Degrees 52'12" West a distance of 106.07'.

Thence South 34 Degrees 41'43" West a distance of 79.06'.

Thence South 69 Degrees 26'38" West a distance of 128.016'.

Thence North 80 Degrees 32'16" West a distance of 91.24'.

Thence South 63 Degrees 26'06" West a distance of 67.08'.

Thence North 33 Degrees 41'24" West a distance of 72.11'.

Thence West a distance of 130.00'.

Thence North 18 Degrees 26'06" East a distance of 73.99' to the beginning of a tangent curve concave Southeasterly and having a radius of 150.00'.

Thence Easterly along said curve through a central angle of 58 Degrees 34'13" a distance of 153.34'.

Thence tangent to said curve North 77 Degrees 00'19" East a distance of 182.70'.

Thence North 40 Degrees 36'05" East a distance of 92.20'.

Thence North 66 Degrees 02'15" West a distance of 98.49'.

Thence North 29 Degrees 21'28" West a distance of 91.79'.

Thence North 77 Degrees 54'19" West a distance of 71.59'.

Thence South 62 Degrees 21'14" West a distance of 118.53'.

Thence North 02 Degrees 12'09" East a distance of 130.10'.

Thence North 17 Degrees 39'00" West a distance of 115.43'.

Thence North a distance of 85.00'.

Thence South 62 Degrees 06'10" West a distance of 96.18'.

Thence South 16 Degrees 59'27" West a distance of 188.22'.

Thence South 36 Degrees 01'39" West a distance of 136.02'.

Thence South 15 Degrees 56'43" West a distance of 145.60'.

Thence South 37 Degrees 34'07" West a distance of 82.01'.

Thence South 18 Degrees 26'06" West a distance of 79.06'.

Thence North 83 Degrees 36'35" West a distance of 135.83'.

Thence South 62 Degrees 06'10" West a distance of 96.18'.

Thence North 26 Degrees 33'54" West a distance of 78.26'.

Thence North 38 Degrees 59'28" East a distance of 135.09'.

Thence North 54 Degrees 46'57" East a distance of 104.04'.

Thence North 20 Degrees 19'23" East a distance of 143.96'.

Thence North 05 Degrees 21'21" East a distance of 321.40'.

Thence South 31 Degrees 49'39" West a distance of 170.66'.

Thence South 12 Degrees 31'34" West a distance of 92.20'.

Thence South 40 Degrees 06'03" West a distance of 124.20'.

Thence South 76 Degrees 36'27" West a distance of 107.94'.

Thence South 55 Degrees 29'29" West a distance of 97.08'.

Thence South 19 Degrees 39'14" West a distance of 74.33'.

Thence North 82 Degrees 52'30" West a distance of 80.62'.

Thence South 12 Degrees 05'41" West a distance of 143.18'.

Thence South 86 Degrees 43'46" West a distance of 175.29'.

Thence South 46 Degrees 16'23" West a distance of 159.14'.

Thence West a distance of 70.00'.

Thence North 42 Degrees 16'25" West a distance of 74.33'.

Thence North a distance of 105.00'.

Thence North 78 Degrees 01'26" West a distance of 168.67'.

Thence North 56 Degrees 18'36" West a distance of 126.10'.

Thence North 60 Degrees 15'18" East a distance of 120.93'.

Thence South 87 Degrees 30'37" East a distance of 115.11'.

Thence North 60 Degrees 38'32" East a distance of 183.58'.

Thence North 73 Degrees 00'33" East a distance of 188.22'.

Thence North 76 Degrees 45'34" West a distance of 174.64'.

Thence North 01 Degrees 38'12" West a distance of 175.07'.

Thence North 08 Degrees 31'51" West a distance of 303.36'.

Thence South 39 Degrees 48'20" West a distance of 78.10'.

Thence South 05 Degrees 26'25" East a distance of 105.48'.

Thence South 15 Degrees 38'32" West a distance of 129.81'.

Thence South 03 Degrees 34'35" West a distance of 80.16'.

Thence South 31 Degrees 25'47" West a distance of 105.48'.

Thence North 43 Degrees 09'09" West a distance of 109.66'.

Thence South 25 Degrees 27'48" West a distance of 116.30'.

Thence North 59 Degrees 44'37" West a distance of 138.92'.

Thence North 80 Degrees 04'26" West a distance of 203.04'.

Thence South 51 Degrees 20'25" West a distance of 96.05'.

Thence South 20 Degrees 33'22" West a distance of 85.44'.

Thence South 82 Degrees 38'51" West a distance of 312.57'.

Thence South 57 Degrees 22'51" West a distance of 148.41'.

Thence North 29 Degrees 14'56" East a distance of 143.27'.

Thence North 10 Degrees 26'15" East a distance of 193.20'.

Thence South 41 Degrees 25'25" West a distance of 113.36'.

Thence South 33 Degrees 01'26" West a distance of 119.27'.

Thence South 83 Degrees 17'25" West a distance of 171.17'.

Thence North 40 Degrees 21'52" West a distance of 131.24'.

Thence North 04 Degrees 34'10" East a distance of 125.45'.

Thence North 07 Degrees 35'45" West a distance of 75.61'.

Thence North 36 Degrees 23'04" East a distance of 118.00'.

Thence South 71 Degrees 01'47" West a distance of 169.19'.

Thence South 36 Degrees 52'12" West a distance of 100.00'.

Thence North 05 Degrees 42'38" East a distance of 100.50'.

Thence 38 Degrees 22'03" East a distance of 153.05'.

Thence North 31 Degrees 40'32" East a distance of 276.13'.

Thence North a distance of 125.00'.

Thence North 14 Degrees 02'10" East a distance of 144.31'.

Thence North 45 Degrees 00'00" East a distance of 141.42'.

Thence North 06 Degrees 50'34" West a distance of 125.90'.

Thence South 45 Degrees 00'00" West a distance of 113.14'.

Thence South 21 Degrees 02'15" West a distance of 69.64'.

Thence North 75 Degrees 04'07" West a distance of 77.62'.

Thence North 11 Degrees 46'05" West a distance of 122.58'.

Thence North 27 Degrees 45'31" West a distance of 107.35'.

Thence South 02 Degrees 07'16" West a distance of 135.09'.

Thence South 06 Degrees 34'55" West a distance of 130.86'.

Thence South 04 Degrees 34'26" East a distance of 125.40'.

Thence South 11 Degrees 00'13" West a distance of 183.37'.

Thence South 63 Degrees 26'06" West a distance of 145.34'.

Thence South 38 Degrees 39'35" West a distance of 96.35'.

Thence South 70 Degrees 42'36" West a distance of 105.95'.

Thence South 25 Degrees 38'28" West a distance of 138.65'.

Thence North 33 Degrees 41'24" West a distance of 108.17'.

Thence North 09 Degrees 43'39" East a distance of 177.55'.

Thence North 18 Degrees 26'06" East a distance of 110.68'.

Thence North 49 Degrees 05'08" West a distance of 99.25'.

Thence South 12 Degrees 31'44" West a distance of 92.20'.

Thence North 71 Degrees 33'54" West a distance of 94.87'.

Thence South 02 Degrees 43'35" East a distance of 105.12'.

Thence South 57 Degrees 22'51" West a distance of 148.41'.

Thence North 59 Degrees 02'10" West a distance of 87.46'.

Thence South 89 Degrees 07'55" West a distance of 174.53' to the beginning of a tangent curve concave Easterly and having a radius of 25.00'.

Thence Southerly along said curve through a central angle of 161 Degrees 44'04" a distance of 70.57'.

Thence tangent to said curve North 70 Degrees 51'59" East a distance of 103.82'.

Thence North 32 Degrees 44'07" East a distance of 83.22'.

Thence North 10 Degrees 05'51" West a distance of 74.15'.

Thence North 33 Degrees 00'11" East a distance of 115.66'.

Thence North 19 Degrees 21'32" East a distance of 196.09'.

Thence North 23 Degrees 57'45" West a distance of 98.49'.

Thence North 20 Degrees 51'16" East a distance of 112.36'.

Thence South 67 Degrees 45'04" West a distance of 118.85'.

Thence South 10 Degrees 32'21" West a distance of 218.69'.

Thence South 87 Degrees 08'15" West a distance of 100.12'.

Thence South 08 Degrees 44'46" East a distance of 65.75'.

Thence South 49 Degrees 05'08" West a distance of 99.25'.

Thence North 30 Degrees 57'50" West a distance of 145.77'.

Thence South 14 Degrees 32'04" West a distance of 139.46'.

Thence North 67 Degrees 50'01" West a distance of 145.77'.

thence South a distance of 90.00'.

Thence South 25 Degrees 51'59" West a distance of 183.37'.

Thence North 54 Degrees 09'44" West a distance of 111.02'.

Thence North 02 Degrees 56'09" West a distance of 195.26'.

Thence North 27 Degrees 45'31" East a distance of 107.35'.

Thence North 23 Degrees 29'55" West a distance of 125.40'.

Thence South 20 Degrees 37'48" West a distance of 454.12'.

Thence South 07 Degrees 18'21" East a distance of 196.60'.

Thence North 78 Degrees 13'54" West a distance of 122.58'.

Thence North 12 Degrees 59'41" West a distance of 200.12'.

Thence North 08 Degrees 58'21" East a distance of 192.35'.

Thence North a distance of 205.05'.

Thence North 29 Degrees 44'42" West a distance of 241.87'.

Thence South 02 Degrees 17'26" East a distance of 125.10'.

Thence South 10 Degrees 29'29" East a distance of 137.30'.

Thence South 15 Degrees 56'43" West a distance of 145.60'.

Thence South 33 Degrees 41'24" West a distance of 108.17'.

Thence South 23 Degrees 57'45" West a distance of 98.49'.

Thence South 16 Degrees 35'14" West a distance of 245.20'.

Thence South 68 Degrees 57'45" West a distance of 139.28'.

Thence North a distance of 95.01'.

Thence South 54 Degrees 27'44" West a distance of 86.02'.

Thence North 10 Degrees 18'17" West a distance of 111.80'.

Thence North 02 Degrees 23'09" East a distance of 120.10'.

Thence North 04 Degrees 23'55" West a distance of 130.38'.

Thence North 38 Degrees 39'35" West a distance of 128.06'.

Thence South 07 Degrees 54'26" East a distance of 181.73'.

Thence South 16 Degrees 41'57" West a distance of 156.60'.

Thence South 08 Degrees 31'51" West a distance of 202.24'.

Thence South 82 Degrees 52'30" West a distance of 80.62'.

Thence North 26 Degrees 33'54" East a distance of 111.80'.

Thence North 05 Degrees 42'38" West a distance of 100.50'.

Thence North 32 Degrees 37'09" West a distance of 148.41'.

Thence North 47 Degrees 38'33" West a distance of 230.05'.

Thence North 84 Degrees 41'08" West a distance of 215.93'.

Thence North a distance of 90.03'.

Thence South 30 Degrees 34'45" West a distance of 127.77'.

Thence South 59 Degrees 32'04" East a distance of 197.23'.

Thence South 12 Degrees 31'44" East a distance of 92.20'.

Thence South 66 Degrees 22'14" East a distance of 87.32'.

Thence South 39 Degrees 33'35" East a distance of 119.16'.

Thence South 26 Degrees 33'54" West a distance of 167.71'.

Thence South 10 Degrees 18'17" West a distance of 111.80'.

Thence South 45 Degrees 00'00" East a distance of 98.99'.

Thence East a distance of 100.00'.

Thence South 23 Degrees 57'45" East a distance of 98.49'.

Thence South 45 Degrees 00'00" East a distance of 113.14'.

Thence South 41 Degrees 38'01" West a distance of 120.42'.

Thence South 77 Degrees 28'16" West a distance of 138.29'.

Thence South 87 Degrees 56'17" West a distance of 139.09'.

Thence South 30 Degrees 57'55" West a distance of 93.29'.

Thence North 82 Degrees 45'20" West a distance of 118.95'.

Thence South 37 Degrees 34'07" West a distance of 246.02'.

Thence North 54 Degrees 09'44" West a distance of 111.02'.

Thence North 86 Degrees 25'25" West a distance of 160.31'.

Thence South 49 Degrees 45'49" West a distance of 85.15'.

Thence North 61 Degrees 36'25" West a distance of 210.30'.

Thence South 84 Degrees 30'28" West a distance of 261.20'.

Thence North 75 Degrees 57'50" West a distance of 268.00'.

Thence South 71 Degrees 06'50" West a distance of 200.81'.

Thence North 59 Degrees 25'15" West a distance of 127.77'.

Thence North 45 Degrees 00'00" West a distance of 212.13'.

Thence North 78 Degrees 41'24" West a distance of 127.48'.

Thence North 49 Degrees 14'11" West a distance of 114.87'.

Thence South 85 Degrees 42'00" West a distance of 133.38'.

Thence North 86 Degrees 22'01" West a distance of 315.63'.

Thence South 47 Degrees 36'09" West a distance of 155.72'.

Thence North 74 Degrees 44'42" West a distance of 114.02'.

Thence South 67 Degrees 22'48" West a distance of 260.00'.

Thence North 11 Degrees 00'13" West a distance of 183.37'.

Thence North 14 Degrees 55'53" East a distance of 155.24'.

Thence North 67 Degrees 45'04" East a distance of 118.85'.

Thence South 73 Degrees 29'44" East a distance of 140.80'.

Thence North 34 Degrees 35'32" West a distance of 176.14'.

Thence North 19 Degrees 32'12" East a distance of 164.47'.

Thence North 75 Degrees 10'25" East a distance of 175.86'.

Thence North 25 Degrees 16'40" West a distance of 199.06'.

Thence North 33 Degrees 30'12" East a distance of 425.73'.

Thence North 03 Degrees 30'50" East a distance of 571.07'.

Thence North 47 Degrees 02'43" West a distance of 198.12'.

Thence South 78 Degrees 41'24" West a distance of 356.93'.

Thence South 86 Degrees 59'14" West a distance of 380.53'.

Thence South 63 Degrees 26'06" West a distance of 301.87'.

Thence South 58 Degrees 46'54" West a distance of 192.94'.

Thence South 39 Degrees 33'35" West a distance of 149.16'.

Thence South 75 Degrees 15'23" West a distance of 196.47'.

Thence North 77 Degrees 11'45" West a distance of 225.61'.

Thence North 65 Degrees 53'52" West a distance of 208.15'.

Thence North 31 Degrees 14'21" West a distance of 356.72'.

Thence North 25 Degrees 36'56" West a distance of 809.57'.

Thence North 55 Degrees 05'51" West a distance of 262.15'.

Thence North 82 Degrees 28'03" West a distance of 244.11'.

Thence South 60 Degrees 10'08" West a distance of 164.84'.

Thence South 71 Degrees 43'56" West a distance of 542.33'.

Thence South 37 Degrees 24'19" West a distance of 214.01'.

Thence South 47 Degrees 21'12" West a distance of 206.65'.

Thence South 34 Degrees 23'22" West a distance of 545.31'.

Thence South 47 Degrees 29'23" West a distance of 162.79'.

Thence North 87 Degrees 13'47" West a distance of 310.36'.

Thence North 50 Degrees 11'40" West a distance of 117.15'.

Thence North 69 Degrees 46'30" West a distance of 202.48'.

Thence North 38 Degrees 59'28" West a distance of 135.09'.

Thence North 23 Degrees 47'35" West a distance of 240.44'.

Thence North 01 Degrees 38'12" West a distance of 280.10'.

Thence North 40 Degrees 36'05" East a distance of 92.20'.

Thence North 03 Degrees 04'44" East a distance of 181.92'.

Thence North 54 Degrees 46'57" West a distance of 1546.13' to the beginning of a tangent curve concave Southerly and having a radius of 1000.00'.

Thence Northwesterly and westerly along said curve through a central angle of 29 Degrees 44'48" a distance of 519.18'.

Thence tangent to said curve North 84 Degrees 31'45" West a distance of 492.72' to the Southeasterly corner of Parcel 7 of Parcel Map 38 as recorded in Book 4, Pages 12 through 13, records of Riverside County, California.

Thence Northeasterly to a turning point in the boundary line of The Pauba Rancho. Said point lies in the North 1/2 of Section 5, Township 8 South, Range 1 West.

Thence leaving said boundary line on a Northeasterly bearing to a point. Said point being an intersection of the East line of Section 8, Township 7 South, Range 1 West with the Northerly boundary line of the Pauba Rancho.

Thence Northerly along the East line of said Section 8 and the East line of Section 5, Township 7 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of said Section 5 and the North line of the East 1/2 of Section 6, Township 7 South, Range 1 West to the Northwest corner thereof.

Thence Northerly along the East line of the West 1/2 of Sections 31 and 30, Township 6 South, Range 1 West to the Northeast corner thereof.

Thence Easterly along the South line of the East 1/2 of Section 19, Township 6 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of said Section 19 to the Northeast corner thereof.

Thence Easterly along the South line of the West 1/2 of the West 1/2 of Section 17, Township 6 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of the West 1/2 of the West 1/2 of said Section 17 to the Northeast corner thereof.

Thence Easterly along the South line of the East 1/2 of the West 1/2 of Section 8, Township 6 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of the East 1/2 of the West 1/2 of said Section 8 to the Northeast corner thereof.

Thence Easterly along the South line of the Southeast 1/4 of Section 5, Township 6 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of the Southeast 1/4 of said Section 5 to the Northeast corner thereof.

Thence Easterly along the South line of the Northwest 1/4 of Section 4, Township 6 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of the Northwest 1/4 of said Section 4 to the Northeast corner thereof.

Thence Easterly along the South line of the Southeast 1/4 of Section 33 and the South line of the Southwest 1/4 of Section 34, Township 5 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of the Southwest 1/4 of said Section 34 to the Northeast corner thereof.

Thence Easterly along the South line of the Northeast 1/4 of said Section 34 and the South line of the South 1/2 of the North 1/2 of Section 35, Township 5 South, Range 1 West to the Southeast corner thereof.

Thence Northerly along the East line of the South 1/2 of the North 1/2 of said Section 35 to the Northeast corner thereof.

Thence Easterly along the South line of the North 1/2 of the North 1/2 of Section 36, Township 5 South, Range 1 West and the South line of the North 1/2 of the North 1/2 of Section 31, Township 5 South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of the North 1/2 of the North 1/2 of said Section 31 to the Northeast corner thereof.

Thence Easterly along the South line of the South 1/2 of Section 29 and 28, Township 5 South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of the South 1/2 of said Section 28 to the Northeast corner thereof.

Thence Easterly along the South line of the Northwest 1/4 of Section 27, Township 5

South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of the Northwest 1/4 of said Section 27 to the Northeast corner thereof.

Thence Easterly along the South line of the East 1/2 of Section 22 and the South line of the West 1/2 of the West 1/2 of Section 23 to the Southeast corner thereof.

Thence Northerly along the East line of the West 1/2 of the West 1/2 of said Section 23 to the Northeast corner thereof.

Thence Westerly along the North line of the West 1/2 of the West 1/2 of said Section 23 to the Northwest corner thereof.

Thence Northerly along the East line of the East 1/2 of Section 15, Township 5 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the East 1/2 of said Section 15 to the Northwest corner thereof.

Thence Northerly along the East line of the West 1/2 of Sections 10 and 3, Township 5 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the West 1/2 of said Section 3 to the Northwest corner thereof.

Thence Northerly along the East line of the East 1/2 of Section 33, Township 4 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the East 1/2 of said Section 33 to the Northwest corner thereof.

Thence Northerly along the East line of the Southwest 1/4 of Section 28, Township 4 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the Southwest 1/4 of said Section 28 to the Northwest corner thereof.

Thence Northerly along the East line of the Northeast 1/4 of Section 29, Township 4 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the Northeast 1/4 of said Section 29 to the Northwest corner thereof.

Thence Northerly along the East line of the Southwest 1/4 of Section 20, Township 4 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the Southwest 1/4 of said Section 20 to the Northwest corner thereof.

Thence Northerly along the East line of the Northeast 1/4 of Section 19, Township 4 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the Northeast 1/4 of said Section 19 to the Northwest corner thereof.

Thence Northerly along the East line of the Southwest 1/4 of Section 18, Township 4 South, Range 1 East to the Northeast corner thereof.

Thence Westerly along the North line of the Southwest 1/4 of said Section 18 and the North line of the Southeast 1/4 of Section 13, Township 4 South, Range 1 West to the Northeast corner thereof.

Thence Northerly along the East line of the Northwest 1/4 of said Section 13 to the Northeast corner thereof.

Thence Westerly along the North line of the Northwest 1/4 of said Section 13 to the Northwest corner thereof.

Thence Northerly along the East line of the South 1/2 of Section 11, Township 4 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of the South 1/2 of said Section 11 to the Northwest corner thereof.

Thence Northerly along the East line of the Northeast 1/4 of Section 10, Township 4 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of the Northeast 1/4 of said Section 10 to the Northwest corner thereof.

Thence Northerly along the East line of the Southwest 1/4 of Section 3, Township 4 South, Range 1 West to the Northeast corner thereof.

Thence Easterly along the South line of the South 1/2 of the Northeast 1/4 of said Section 3 to the Southeast corner thereof.

Thence Northerly along the East line of the South 1/2 of the Northeast 1/4 of said Section 3 to the Northeast corner thereof.

Thence Easterly along the South line of the North 1/2 of the North 1/2 of Sections 2 and 1, Township 4 South, Range 1 West and the South line of the Northwest 1/4 of the Northwest 1/4 of Section 6, Township 4 South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of the Northwest 1/4 of the Northwest 1/4 of said Section 6 to the Northeast corner thereof.

Thence Easterly along the South line of the West 1/2 and the South line of the West 1/2 of the East 1/2 of Section 31, Township 3 South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of the West 1/2 of the East 1/2 of said Section 31 to the Northeast corner thereof.

Thence Easterly along the South line of the East 1/2 of the East 1/2 of Section 30, Township 3 South, Range 1 East to the Southeast corner thereof.

Thence Northerly along the East line of said Section 30 to the Northeast corner thereof.

Thence Westerly along the North line of said Section 30 to the Northwest corner thereof.

Thence Northerly along the East line of the North 1/2 of Section 25 and the East line of the South 1/2 of Section 24, Township 3 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of the South 1/2 of said Section 24 and the North line of the Southeast 1/4 of Section 23, Township 3 South, Range 1 West to the Northwest corner thereof.

Thence Southerly along the West line of the Southeast 1/4 of said Section 23 and the West line of the East 1/2 of Section 26 and the West line of the Northeast 1/4 of Section 35, Township 3 South, Range 1 West to the Southwest corner thereof.

Thence Westerly along the North line of the Southwest 1/4 of said Section 35 and the North line of the Southeast 1/4 and the North line of the East 1/2 of the Southwest 1/4 of Section 34, Township 3 South, Range 1 West to the Northwest corner thereof.

Thence Westerly along the North line of the West 1/2 of the Northwest 1/4 of Section 3 and the North line of Section 4, Township 3 South, Range 1 West to the Northwest corner thereof.

Thence Northerly along the East line of the Section 32, Township 3 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of said Section 32 to the Northwest corner thereof.

Thence Northerly along the East line of Section 30, Township 3 South, Range 1 West to the Northeast corner thereof.

Thence Westerly along the North line of the said Section 30 to the Northwest corner thereof.

Thence Northerly along the East line of the East 1/2 of Section 24, Township 3 South, Range 2 West to the Northeast corner thereof.

Thence Westerly along the North line of the East 1/2 of said Section 24 to the Northwest corner thereof.

Thence Northerly along the East line of the West 1/2 of Sections 13 and 12, Township 3 South, Range 2 West to the Northeast corner thereof.

Thence Westerly along the North line of the West 1/2 of said Section 12 and the North line of Sections 11 and 10, Township 3 South, Range 2 West to the Northwest corner thereof.

Thence Northerly along the East line of Section 4, Township 3 South, Range 2 West to the Northeast corner thereof.

Thence Westerly along the North line of said Section 4 to the Northwest corner thereof.

Thence Northerly along the East line of the South 1/2 of Section 32, Township 2 South, Range 2 West to the Northeast corner thereof.

Thence Westerly along the North line of the South 1/2 of said Section 32 of the Northwest corner thereof.

Thence Northerly along the East line of the North 1/2 of Section 31, Township 2 South, Range 2 West to the Northeast corner thereof.

Thence Westerly along the North line of said Section 31 to the Northwest corner thereof.

Thence Northerly along the East line of the Southeast 1/4 of Section 25, Township 2 South, Range 3 West to the Northeast corner thereof.

Thence Westerly along the North line of the Southeast 1/4 of said Section 25 to the Northwest corner thereof.

Thence Northerly along the East line of the Northwest 1/4 of said Section 25 to the Northeast corner thereof.

Thence Westerly along the North line of the Northwest 1/4 of said Section 25 to the Northwest corner thereof.

Thence Northerly along the East line of the South 1/2 of Section 23, Township 2 South, Range 3 West to the Northeast corner thereof.

Thence Westerly along the North line of the South 1/2 of said Section 23 to the Northwest corner thereof.

Thence Northerly along the East line of the North 1/2 of Section 22, Township 2 South, Range 3 West to the Northeast corner thereof.

Thence Westerly along the North line of the North 1/2 of said Section 22 to the Northwest corner thereof.

Thence Northerly along the East line of the South 1/2 of Section 16, Township 2 South, Range 3 West to the Northeast corner thereof.

Thence Westerly along the North line of the South 1/2 of said Section 16 to the Northwest corner thereof.

Thence Northerly along the East line of the North 1/2 of Section 17, Township 2 South, Range 3 West to the Northeast corner thereof. Said point also being a point in the Northerly boundary line of the County of Riverside, California.

Thence following said boundary line Westerly, Northerly and Westerly to the TRUE POINT OF BEGINNING.

Section 6. MITIGATION FEE. All applicants for development permits within the boundaries of the Fee Assessment Area who cannot satisfy mitigation requirements through on-site mitigation as determined through the environmental review process shall pay a Mitigation Fee of $500.00 per gross acre of the parcels proposed for development.

However, for single family residential development, wherein all lots within the development are greater than one-half (1/2) acre in size, a Mitigation Fee of $250.00 per residential unit shall be paid; and for agricultural development which requires a development permit excluding the construction of single family residences in connection with said agricultural development, a Mitigation Fee of $100.00 or one percent (1%) of the valuation of the buildings to be constructed whichever is greater shall be paid, provided that at no time shall such fee exceed the amount required to be paid if a fee of $500.00 per gross acre were applied to the parcel proposed for agricultural development. The determination of value or valuation of an agricultural building shall be made by the building official.

Section 7. IMPOSITION OF FEE. No development permit for real property located within the boundaries of the Fee Assessment Area shall be issued or approved except upon the condition that on-site mitigation will be provided as determined through the environmental review process or the Mitigation Fee required by this ordinance be paid, and it is determined that said development will not jeopardize the implementation of a Habitat Conservation Plan for the Stephens' Kangaroo Rat.

Section 8. PAYMENT OF FEE. The Mitigation Fee shall be paid upon issuance of a grading permit or a certificate of occupancy or upon final inspection, whichever occurs first. Payment of the Mitigation Fee shall satisfy County conditions of approval previously placed on development permits with regard to impact mitigation for the Stephens' Kangaroo Rat which have not been previously satisfied and no further review and approval pursuant to the provisions of this ordinance shall be required.

For a parcel subject to a surface mining permit, the Mitigation Fee due pursuant to the provisions of this ordinance shall be paid upon submission of an application for a special inspection permit under Ordinance No. 555 prior to the commencement of the mining operation or in the alternative, may be paid in increments upon submission of an application for a special inspection permit under Ordinance No. 555 prior to the commencement of each phase of the mining operation authorized by the surface mining permit. Each increment of payment shall be equal to $1,950.00 multiplied by the sum of (1) the total number of surface acres of land within the applicable phase pursuant to the surface mining permit and (2) the quotient which results from dividing the total number of acres of land covered by the surface mining permit and subject to this ordinance, which are prohibited from disturbance or designated as setback or buffer areas pursuant to the surface mining permit, by the total number of approved phases. The total number of surface acres of land within each phase shall be determined through a physical survey prepared by a licensed surveyor or registered civil engineer.

Section 8.1. DEFERRAL OF PAYMENT OF THE FEE. At the option of the applicant for a grading permit, payment of the Mitigation Fee may be deferred until the issuance of the first building permit within the parcels proposed for development. Prior to issuance of the grading permit, an instrument shall be recorded by the applicant in the Office of the County Recorder of Riverside County which gives notice that prior to issuance of the first building permit, the entire Mitigation Fee as calculated prior to issuance of the grading permit shall be required to be paid.

Section 9. REDUCTION FOR NON-PROFIT ENTITIES. The fees required pursuant to Section 6 shall be reduced by 75 percent for non-profit entities. For purposes of this section, non-profit entities shall be defined as those entities identified in 26 U.S.C. Section 501(c)(3).

Section 10. EXEMPTIONS. For purposes of this ordinance, the following types of development shall not be required to pay the Mitigation Fee unless such development voluntarily participates in order to mitigate the disturbance of occupied Stephens' Kangaroo Rat habitat:

(a) Reconstruction of any structure damaged or destroyed by fire or other natural causes;

(b) Rehabilitation or remodeling of existing structures, or additions to existing structures;

(c) Development of any parcel for which the California Department of Fish and Game has approved other mitigation procedures;

(d) Development of any parcel used by local, state or federal entities for governmental purposes (i.e. public works, schools);

(e) Development of any parcel for which the Mitigation Fee has been previously paid. However, in instances where the fee previously paid was the fee for single family residential development, wherein all lots within the development were greater than 1/2 gross acre in size, and the applicant for a development permit subsequently requests an increase in residential density or a change from a residential to a non-residential use, or in instances where the fee previously paid was the fee for agricultural development and the applicant for a development permit subsequently requests a change from an agricultural to a residential, commercial or industrial use, the fee shall be recalculated for the new density or use pursuant to the provisions of this ordinance. Any difference between the recalculated fee and the previously paid fee shall be required to be paid by the applicant.

(f) The construction of public utility transmission facilities where ground surface disturbance is minimal or where substantially all of the disturbed ground surface can be restored to its original condition as may be determined by the Planning Director. Said exemption shall not include substations, treatment facilities or pumping stations.

(g) Development of any parcel for which approval of a tentative tract map, tentative parcel map, conditional use permit, public use permit, plot plan or surface mining permit is sought and said development will not require the construction of new or additional buildings or the grading or mining of the parcel which may be considered negligible or insignificant as determined by the Planning Director.

(h) Development of any parcel for which approval of an amendment, minor change or revision to a tentative tract map or tentative parcel map is sought; or development of any parcel for which approval of a request for substantial conformance or a revised conditional use permit, public use permit or plot plan is sought; or development of any parcel for which approval of an application for substantial conformance or a minor change to a surface mining permit is sought; and all grading permits necessary for the development of the parcel have previously been issued.

Section 11. REFUND.

(1) In the event that the fee provided for by the final Habitat Conservation Plan is Less than the Mitigation Fee paid, the current property owner of record may apply for a partial refund of said fee. The amount of any refund due shall be determined by the County in its sole discretion after review of said application and shall be limited to the funds collected in excess of any amount received as a credit against the Habitat Conservation and Open Space Land Bank Fee pursuant to the provisions of Ordinance No. 659.

(2) If an applicant for a grading permit has paid the Mitigation Fee pursuant to the provisions of this ordinance and said fee would not have been required to be paid, had Subsections (m)(l) and (2) of Section 4 of Ordinance No. 663 been in effect at the time of payment, the applicant may apply for a refund of the Mitigation Fee paid. The Building Director shall make the determination as to whether the applicant is entitled to a refund of the fee paid and shall provide a refund, if appropriate.

Section 12. FEE ADJUSTMENT. The Board of Supervisors may periodically review and cause an adjustment to be made to the Mitigation Fee. By amendment to this ordinance, the fee may be increased or decreased to reflect changes in estimated costs for the development, preparation and implementation of a Habitat Conservation Plan. The adjustment in the fee may also reflect changes in estimated revenues received pursuant to this ordinance, as well as the availability or lack thereof of other funds with which to prepare and implement the Habitat Conservation Plan. Any adjustment in the fee shall be prospective only and shall become effective as of the date any such amendment is effective, provided however, that the amount of the Mitigation Fee for any development permit shall be the fee in effect at the time of payment.

Section 13. FEE ADMINISTRATION. All Mitigation Fees collected pursuant to the provisions of this ordinance shall be deposited into a Mitigation Fee Account. Funds in said account shall be expended solely for the development, preparation and implementation of a Habitat Conservation Plan for the Stephens' Kangaroo Rat, including the acquisition of habitat reserve sites, and for the application for a Section 10(a) permit under the Federal Endangered Species Act of 1973.

Section 14. VALIDITY. This ordinance and the various parts, sections and clauses thereof are hereby declared to be severable. If any part, sentence, paragraph, section or clause is adjudged unconstitutional or invalid, the remainder of this ordinance shall not be affected thereby. If any part, sentence, paragraph, section or clause of this ordinance, or its application to any person or entity is adjudged unconstitutional or invalid, such unconstitutionality or invalidity shall affect only such part, sentence, paragraph, section or clause of this ordinance, or person or entity; and shall not affect or impair any of the remaining provisions, parts, sentences, paragraphs, sections or clauses of this ordinance, or its application ot other persons or entities. The Board of Supervisors hereby declares that this ordinance would have been adopted had such unconstitutional or invalid part, sentence, paragraph, section or clause of this ordinance not been included herein; or had such person or entity been expressly exempted from the application of this ordinance.

Section 15. CREDIT. Where a development project is subject to the provisions of a Development Agreement entered into with the County pursuant to the provisions of Government Code Section 65864 et seq. and the project involves the construction of residential units, the Mitigation Fee required to be paid pursuant to the provisions of this ordinance shall be reduced by $175.00 per residential unit.

This ordinance is an urgency measure and shall take effect immeditely upon its adoption. Ordinance No. 663 previously provided for termination of the Mitigation Fee upon issuance of a Section (10)a permit. It is anticipated that the Secretary of the Interior will approve an Interim Habitat Conservation Plan for the Stephens' Kangaroo Rat and issue a Section 10(a) permit during the last week of January or the week of February 1990. The Mitigation Fee is a required component of the Interim Habitat Conservation Plan for the Stephens' Kangaroo Rat. It is therefore necessary that this ordinance be adopted as an urgency measure in order for the Mitigation Fee to remain in effect and for the immediate preservation of the species and the public peace, health and safety. The Board declares that this ordinance shall be construed as a continuation of existing Ordinance No. 663 and not as a new enactment, except as to any provisions of this ordinance which are inconsistent therewith. Any development permit previously issued pursuant to Ordinance No. 663 and complying therewith shall be deemed to comply with this ordinance.

Adopted: 663 Item 3.40 of 11/15/1988 (Eff: 01/14/1989)
663.1 Item 10.2 of 12/13/1988 (Eff. 12/13/1988)
663.2 Item 3.27 of 08/29/1989 (Eff. 10/28/1989)
663.3 Item 3.11 of 03/21/1989 (Eff. 04/20/1989)
663.4 Item 3.14 of 11/28/1989 (Eff. 12/28/1989)
663.5 Item 3.6 of 01/02/1990 (Eff. 01/02/1990)
663.6 Item 3.2 of 09/28/1993 (Eff. 11/27/1993)
(663.7 thru 663.9: not adopted)
663.10 Item 3.1a of 08/06/1996 (Eff. 09/05/1996)

Staff Report on Burrowing Owl Mitigation

State of California

Natural Resources Agency

Department of Fish and Game

March 7, 2012[1]

[1] This document replaces the Department of Fish and Game 1995 Staff Report On Burrowing Owl Mitigation.

TABLE OF CONTENTS

INTRODUCTION AND PURPOSE

Maintaining California's rich biological diversity is dependent on the conservation of species and their habitats. The California Department of Fish and Game (Department) has designated certain species as "species of special concern" when their population viability and survival is adversely affected by risk factors such as precipitous declines or other vulnerability factors (Shuford and Gardali 2008). Preliminary analyses of regional patterns for breeding populations of burrowing owls (*Athene cunicularia*) have detected declines both locally in their central and southern coastal breeding areas, and statewide where the species has experienced modest breeding range retraction (Gervais et al. 2008). In California, threat factors affecting burrowing owl populations include habitat loss, degradation and modification, and eradication of ground squirrels resulting in a loss of suitable burrows required by burrowing owls for nesting, protection from predators, and shelter (See Appendix A).

The Department recognized the need for a comprehensive conservation and mitigation strategy for burrowing owls, and in 1995 directed staff to prepare a report describing mitigation and survey recommendations. This report, "1995 Staff Report on Burrowing Owl Mitigation," (Staff Report) (CDFG 1995), contained Department-recommended burrowing owl and burrow survey techniques and mitigation measures intended to offset the loss of habitat and slow or reverse further decline of this species. Notwithstanding these measures, over the past 15+ years, burrowing owls have continued to decline in portions of their range (DeSante et al. 2007, Wilkerson and Siegel, 2010). The Department has determined that reversing declining population and range trends for burrowing owls will require implementation of more effective conservation actions, and evaluating the efficacy of the Department's existing recommended avoidance, minimization and mitigation approaches for burrowing owls.

The Department has identified three main actions that together will facilitate a more viable, coordinated, and concerted approach to conservation and mitigation for burrowing owls in California. These include:

1. Incorporating burrowing owl comprehensive conservation strategies into landscape-based planning efforts such as Natural Community Conservation Plans (NCCPs) and multi-species Habitat Conservation Plans (HCPs) that specifically address burrowing owls.
2. Developing and implementing a statewide conservation strategy (Burkett and Johnson, 2007) and local or regional conservation strategies for burrowing owls, including the development and implementation of a statewide burrowing owl survey and monitoring plan.
3. Developing more rigorous burrowing owl survey methods, working to improve the adequacy of impacts assessments; developing clear and effective avoidance and minimization measures; and developing mitigation measures to ensure impacts to the species are effectively addressed at the project, local, and/or regional level (the focus of this document).

This Report sets forth the Department's recommendations for implementing the third approach identified above by revising the 1995 Staff Report, drawing from the most relevant and current knowledge and expertise, and incorporating the best scientific information available pertaining to the species. It is designed to provide a compilation of the best available science for Department staff, biologists, planners, land managers, California Environmental Quality Act (CEQA) lead agencies, and the public to consider when assessing impacts of projects or other activities on burrowing owls.

This revised Staff Report takes into account the California Burrowing Owl Consortium's Survey Protocol and Mitigation Guidelines (CBOC 1993, 1997) and supersedes the survey, avoidance, minimization and mitigation recommendations in the 1995 Staff Report. Based on experiences gained from implementing the 1995 Staff Report, the Department believes revising that report is warranted. This document also includes general conservation goals and principles for developing mitigation measures for burrowing owls.

DEPARTMENT ROLE AND LEGAL AUTHORITIES

The mission of the Department is to manage California's diverse fish, wildlife and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. The Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitats necessary to maintain biologically sustainable populations of those species (Fish and Game Code (FGC) §1802). The Department, as trustee agency pursuant to CEQA (See CEQA Guidelines, §15386), has jurisdiction by law over natural resources, including fish and wildlife, affected by a project, as that term is defined in Section 21065 of the Public Resources Code. The Department exercises this authority by reviewing and commenting on environmental documents and making recommendations to avoid, minimize, and mitigate potential negative impacts to those resources held in trust for the people of California.

Field surveys designed to detect the presence of a particular species, habitat element, or natural community are one of the tools that can assist biologists in determining whether a species or habitat may be significantly impacted by land use changes or disturbance. The Department reviews field survey data as well as site-specific and regional information to evaluate whether a project's impacts may be significant. This document compiles the best available science for conducting habitat assessments and surveys, and includes considerations for developing measures to avoid impacts or mitigate unavoidable impacts.

CEQA

CEQA requires public agencies in California to analyze and disclose potential environmental impacts associated with a project that the agency will carry out, fund, or approve. Any potentially significant impact must be mitigated to the extent feasible. Project-specific CEQA mitigation is important for burrowing owls because most populations exist on privately owned parcels that, when proposed for development or other types of modification, may be subject to the environmental review requirements of CEQA.

Take

Take of individual burrowing owls and their nests is defined by FGC section 86, and prohibited by sections 3503, 3503.5 and 3513. Take is defined in FGC Section 86 as "hunt, pursue, catch, capture or kill, or attempt to hunt, pursue, catch, capture or kill."

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and Russia for the protection of migratory birds, including the burrowing owl (50 C.F.R. § 10). The MBTA protects migratory bird nests from possession, sale, purchase, barter, transport, import and export, and collection. The other prohibitions of the MBTA - capture, pursue, hunt, and kill - are inapplicable to nests. The regulatory definition of take, as defined in Title 50 C.F.R. part 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to hunt, shoot, wound, kill, trap, capture, or collect. Only the verb "collect" applies to nests. It is illegal to collect, possess, and by any means transfer possession of any migratory bird nest. The MBTA prohibits the destruction of a nest when it contains birds or eggs, and no possession shall occur during the destruction (see Fish and Wildlife Service, Migratory Bird Permit Memorandum, April 15, 2003). Certain exceptions to this prohibition are included in 50 C.F.R. section 21. Pursuant to Fish & Game Code section 3513, the Department enforces the Migratory Bird Treaty Act consistent with rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Treaty Act.

Regional Conservation Plans

Regional multiple species conservation plans offer long-term assurances for conservation of covered species at a landscape scale, in exchange for biologically appropriate levels of incidental take and/or habitat loss as defined in the approved plan. California's NCCP Act (FGC §2800 et seq.) governs such plans at the state level, and was designed to conserve species, natural communities, ecosystems, and ecological processes across a jurisdiction or a collection of jurisdictions. Complementary federal HCPs are governed by the Endangered Species Act (7 U.S.C. § 136, 16 U.S.C.§ 1531 et seq.) (ESA). Regional conservation plans (and certain other landscape-level conservation and management plans), may provide conservation for unlisted as well as listed species. Because the geographic scope of NCCPs and HCPs may span many hundreds of thousands of acres, these planning tools have the potential to play a significant role in conservation of burrowing owls, and grasslands and other habitats.

Fish and Game Commission Policies

There are a number of Fish and Game Commission policies (see FGC §2008) that can be applied to burrowing owl conservation. These include policies on: Raptors, Cooperation, Endangered and Threatened Species, Land Use Planning, Management and Utilization of Fish and Wildlife on Federal Lands, Management and Utilization of Fish and Wildlife on Private Lands, and Research.

GUIDING PRINCIPLES FOR CONSERVATION

Unless otherwise provided in a statewide, local, or regional conservation strategy, surveying and evaluating impacts to burrowing owls, as well as developing and implementing avoidance, minimization, and mitigation and conservation measures incorporate the following principles. These principles are a summary of Department staff expert opinion and were used to guide the preparation of this document.

1. Use the Precautionary Principle (Noss et al.1997), by which the alternative of increased conservation is deliberately chosen in order to buffer against incomplete knowledge of burrowing owl ecology and uncertainty about the consequences to burrowing owls of potential impacts, including those that are cumulative.
2. Employ basic conservation biology tenets and population-level approaches when determining what constitutes appropriate avoidance, minimization, and mitigation for impacts. Include mitigation effectiveness monitoring and reporting, and use an adaptive management loop to modify measures based on results.
3. Protect and conserve owls in wild, semi-natural, and agricultural habitats (conserve is defined at FGC §1802).
4. Protect and conserve natural nest burrows (or burrow surrogates) previously used by burrowing owls and sufficient foraging habitat and protect auxiliary "satellite" burrows that contribute to burrowing owl survivorship and natural behavior of owls.

CONSERVATION GOALS FOR THE BURROWING OWL IN CALIFORNIA

It is Department staff expert opinion that the following goals guide and contribute to the short and long-term conservation of burrowing owls in California:

1. Maintain size and distribution of extant burrowing owl populations (allowing for natural population fluctuations).
2. Increase geographic distribution of burrowing owls into formerly occupied historical range where burrowing owl habitat still exists, or where it can be created or enhanced, and where the reason for its local disappearance is no longer of concern.
3. Increase size of existing populations where possible and appropriate (for example, considering basic ecological principles such as carrying capacity, predator-prey relationships, and inter-specific relationships with other species at risk).
4. Protect and restore self-sustaining ecosystems or natural communities which can support burrowing owls at a landscape scale, and which will require minimal long-term management.
5. Minimize or prevent unnatural causes of burrowing owl population declines (e.g., nest burrow destruction, chemical control of rodent hosts and prey).
6. Augment/restore natural dynamics of burrowing owl populations including movement and genetic exchange among populations, such that the species does not require future listing and protection under the California Endangered Species Act (CESA) and/or the federal Endangered Species Act (ESA).
7. Engage stakeholders, including ranchers; farmers; military; tribes; local, state, and federal agencies; non-governmental organizations; and scientific research and education communities involved in burrowing owl protection and habitat management.

ACTIVITIES WITH THE POTENTIAL TO TAKE OR IMPACT BURROWING OWLS

The following activities are examples of activities that have the potential to take burrowing owls, their nests or eggs, or destroy or degrade burrowing owl habitat: grading, disking, cultivation, earthmoving, burrow blockage, heavy equipment compacting and crushing burrow tunnels, levee maintenance, flooding, burning and mowing (if burrows are impacted), and operating wind turbine collisions (collectively hereafter referred to as "projects" or "activities" whether carried out pursuant to CEQA or not). In addition, the following activities may have impacts to burrowing owl populations: eradication of host burrowers; changes in vegetation management (i.e. grazing); use of pesticides and rodenticides; destruction, conversion or degradation of nesting, foraging, over-wintering or other habitats; destruction of natural burrows and burrow surrogates; and disturbance which may result in harassment of owls at occupied burrows.

PROJECT IMPACT EVALUATIONS

The following three progressive steps are effective in evaluating whether projects will result in impacts to burrowing owls. The information gained from these steps will inform any subsequent avoidance, minimization and mitigation measures. The steps for project impact evaluations are: 1) habitat assessment, 2) surveys, and 3) impact assessment. Habitat assessments are conducted to evaluate the likelihood that a site supports burrowing owl. Burrowing owl surveys provide information needed to determine the potential effects of proposed projects and activities on burrowing owls, and to avoid take in accordance with FGC sections 86, 3503, and 3503.5. Impact assessments evaluate the extent to which burrowing owls and their habitat may be impacted, directly or indirectly, on and within a reasonable distance of a proposed CEQA project activity or non-CEQA project. These three site evaluation steps are discussed in detail below.

Biologist Qualifications

The current scientific literature indicates that only individuals meeting the following minimum qualifications should perform burrowing owl habitat assessments, surveys, and impact assessments:

1. Familiarity with the species and its local ecology;
2. Experience conducting habitat assessments and non-breeding and breeding season surveys, or experience with these surveys conducted under the direction of an experienced surveyor;
3. Familiarity with the appropriate state and federal statutes related to burrowing owls, scientific research, and conservation;
4. Experience with analyzing impacts of development on burrowing owls and their habitat.

Habitat Assessment Data Collection and Reporting

A habitat assessment is the first step in the evaluation process and will assist investigators in determining whether or not occupancy surveys are needed. Refer to Appendix B for a definition of burrowing owl habitat. Compile the detailed information described in Appendix C when conducting project scoping, conducting a habitat assessment site visit and preparing a habitat assessment report.

Surveys

Burrowing owl surveys are the second step of the evaluation process and the best available scientific literature recommends that they be conducted whenever burrowing owl habitat or sign (see Appendix B) is encountered on or adjacent to (within 150 meters) a project site

(Thomsen 1971, Martin 1973). Occupancy of burrowing owl habitat is confirmed at a site when at least one burrowing owl, or its sign at or near a burrow entrance, is observed within the last three years (Rich 1984). Burrowing owls are more detectable during the breeding season with detection probabilities being highest during the nestling stage (Conway et al. 2008). In California, the burrowing owl breeding season extends from 1 February to 31 August (Haug et al. 1993, Thompsen 1971) with some variances by geographic location and climatic conditions. Several researchers suggest three or more survey visits during daylight hours (Haug and Diduik 1993, CBOC 1997, Conway and Simon 2003) and recommend each visit occur at least three weeks apart during the peak of the breeding season, commonly accepted in California as between 15 April and 15 July (CBOC 1997). Conway and Simon (2003) and Conway et al. (2008) recommended conducting surveys during the day when most burrowing owls in a local area are in the laying and incubation period (so as not to miss early breeding attempts), during the nesting period, and in the late nestling period when most owls are spending time above ground.

Non-breeding season (1 September to 31 January) surveys may provide information on burrowing owl occupancy, but do not substitute for breeding season surveys because results are typically inconclusive. Burrowing owls are more difficult to detect during the non-breeding season and their seasonal residency status is difficult to ascertain. Burrowing owls detected during non-breeding season surveys may be year-round residents, young from the previous breeding season, pre-breeding territorial adults, winter residents, dispersing juveniles, migrants, transients or new colonizers. In addition, the numbers of owls and their pattern of distribution may differ during winter and breeding seasons. However, on rare occasions, non-breeding season surveys may be warranted (i.e., if the site is believed to be a wintering site only based on negative breeding season results). Refer to Appendix D for information on breeding season and non-breeding season survey methodologies.

Survey Reports

Adequate information about burrowing owls present in and adjacent to an area that will be disturbed by a project or activity will enable the Department, reviewing agencies and the public to effectively assess potential impacts and will guide the development of avoidance, minimization, and mitigation measures. The survey report includes but is not limited to a description of the proposed project or proposed activity, including the proposed project start and end dates, as well as a description of disturbances or other activities occurring on-site or nearby. Refer to Appendix D for details included in a survey report.

Impact Assessment

The third step in the evaluation process is the impact assessment. When surveys confirm occupied burrowing owl habitat in or adjoining the project area, there are a number of ways to assess a project's potential significant impacts to burrowing owls and their habitat. Richardson and Miller (1997) recommended monitoring raptor behavior prior to developing management recommendations and buffers to determine the extent to which individuals have been sensitized to human disturbance. Monitoring results will also provide detail necessary for developing site-specific measures. Postovit and Postovit (1987) recommended an analytical approach to mitigation planning: define the problem (impact), set goals (to guide mitigation development), evaluate and select mitigation methods, and monitor the results.

Define the problem. The impact assessment evaluates all factors that could affect burrowing owls. Postovit and Postovit (1987) recommend evaluating the following in assessing impacts to raptors and planning mitigation: type and extent of disturbance, duration and timing of disturbance, visibility of disturbance, sensitivity and ability to habituate, and influence of environmental factors. They suggest identifying and addressing all potential direct and indirect impacts to burrowing owls, regardless of whether or not the impacts will occur during the breeding season. Several examples are given for each impact category below; however, examples are not intended to be used exclusively.

Type and extent of the disturbance. The impact assessment describes the nature (source) and extent (scale) of potential project impacts on occupied, satellite and unoccupied burrows including acreage to be lost (temporary or permanent), fragmentation/edge being created, increased distance to other nesting and foraging habitat, and habitat degradation. Discuss any project activities that impact either breeding and/or non-breeding habitat which could affect owl home range size and spatial configuration, negatively affect onsite and offsite burrowing owl presence, increase energetic costs, lower reproductive success, increase vulnerability to predation, and/or decrease the chance of procuring a mate.

Duration and timing of the impact. The impact assessment describes the amount of time the burrowing owl habitat will be unavailable to burrowing owls (temporary or permanent) on the site and the effect of that loss on essential behaviors or life history requirements of burrowing owls, the overlap of project activities with breeding and/or non-breeding seasons (timing of nesting and/or non-breeding activities may vary with latitude and climatic conditions, which should be considered with the timeline of the project or activity), and any variance of the project activities in intensity, scale and proximity relative to burrowing owl occurrences.

Visibility and sensitivity. Some individual burrowing owls or pairs are more sensitive than others to specific stimuli and may habituate to ongoing visual or audible disturbance. Site-specific monitoring may provide clues to the burrowing owl's sensitivities. This type of assessment addresses the sensitivity of burrowing owls within their nesting area to humans on foot, and vehicular traffic. Other variables are whether the site is primarily in a rural versus urban setting, and whether any prior disturbance (e.g., human development or recreation) is known at the site.

Environmental factors. The impact assessment discusses any environmental factors that could be influenced or changed by the proposed activities including nest site availability, predators, prey availability, burrowing mammal presence and abundance, and threats from other extrinsic factors such as human disturbance, urban interface, feral animals, invasive species, disease or pesticides.

Significance of impacts. The impact assessment evaluates the potential loss of nesting burrows, satellite burrows, foraging habitat, dispersal and migration habitat, wintering habitat, and habitat linkages, including habitat supporting prey and host burrowers and other essential habitat attributes. This assessment determines if impacts to the species will result in significant impacts to the species locally, regionally and range-wide per CEQA Guidelines §15382 and Appendix G. The significance of the impact to habitat depends on the extent of habitat disturbed and length of time the habitat is unavailable (for example: minor – several days, medium – several weeks to months, high - breeding season affecting juvenile survival, or over winter affecting adult survival).

Cumulative effects. The cumulative effects assessment evaluates two consequences: 1) the project's proportional share of reasonably foreseeable impacts on burrowing owls and habitat caused by the project or in combination with other projects and local influences having impacts on burrowing owls and habitat, and 2) the effects on the regional owl population resulting from the project's impacts to burrowing owls and habitat.

Mitigation goals. Establishing goals will assist in planning mitigation and selecting measures that function at a desired level. Goals also provide a standard by which to measure mitigation success. Unless specifically provided for through other FGC Sections or through specific regulations, take, possession or destruction of individual burrowing owls, their nests and eggs is prohibited under FGC sections 3503, 3503.5 and 3513. Therefore, a required goal for all project activities is to avoid take of burrowing owls. Under CEQA, goals would consist of measures that would avoid, minimize and mitigate impacts to a less than significant level. For individual projects, mitigation must be roughly proportional to the level of impacts, including cumulative impacts, in accordance with the provisions of CEQA (CEQA Guidelines, §§ 15126.4(a)(4)(B), 15064, 15065, and 16355). In order for mitigation measures to be effective, they must be specific, enforceable, and feasible actions that will improve environmental conditions. As set forth in more detail in Appendix A, the current scientific literature supports the conclusion that mitigation for permanent habitat loss necessitates replacement with an equivalent or greater habitat area for breeding, foraging, wintering, dispersal, presence of burrows, burrow surrogates, presence of fossorial mammal dens, well drained soils, and abundant and available prey within close proximity to the burrow.

MITIGATION METHODS

The current scientific literature indicates that any site-specific avoidance or mitigation measures developed should incorporate the best practices presented below or other practices confirmed by experts and the Department. The Department is available to assist in the development of site-specific avoidance and mitigation measures.

Avoiding. A primary goal is to design and implement projects to seasonally and spatially avoid negative impacts and disturbances that could result in take of burrowing owls, nests, or eggs. Other avoidance measures may include but not be limited to:

- Avoid disturbing occupied burrows during the nesting period, from 1 February through 31 August.
- Avoid impacting burrows occupied during the non-breeding season by migratory or non-migratory resident burrowing owls.
- Avoid direct destruction of burrows through chaining (dragging a heavy chain over an area to remove shrubs), disking, cultivation, and urban, industrial, or agricultural development.
- Develop and implement a worker awareness program to increase the on-site worker's recognition of and commitment to burrowing owl protection.
- Place visible markers near burrows to ensure that farm equipment and other machinery does not collapse burrows.
- Do not fumigate, use treated bait or other means of poisoning nuisance animals in areas where burrowing owls are known or suspected to occur (e.g., sites observed with nesting

owls, designated use areas).
- Restrict the use of treated grain to poison mammals to the months of January and February.

Take avoidance (pre-construction) surveys. Take avoidance surveys are intended to detect the presence of burrowing owls on a project site at a fixed period in time and inform necessary take avoidance actions. Take avoidance surveys may detect changes in owl presence such as colonizing owls that have recently moved onto the site, migrating owls, resident burrowing owls changing burrow use, or young of the year that are still present and have not dispersed. Refer to Appendix D for take avoidance survey methodology.

Site surveillance. Burrowing owls may attempt to colonize or re-colonize an area that will be impacted; thus, the current scientific literature indicates a need for ongoing surveillance at the project site during project activities is recommended. The surveillance frequency/effort should be sufficient to detect burrowing owls if they return. Subsequent to their new occupancy or return to the site, take avoidance measures should assure with a high degree of certainty that take of owls will not occur.

Minimizing. If burrowing owls and their habitat can be protected in place on or adjacent to a project site, the use of buffer zones, visual screens or other measures while project activities are occurring can minimize disturbance impacts. Conduct site-specific monitoring to inform development of buffers (see Visibility and sensitivity above). The following general guidelines for implementing buffers should be adjusted to address site-specific conditions using the impact assessment approach described above. The CEQA lead agency and/or project proponent is encouraged to consult with the Department and other burrowing owl experts for assistance in developing site-specific buffer zones and visual screens.

Buffers. Holroyd et al. (2001) identified a need to standardize management and disturbance mitigation guidelines. For instance, guidelines for mitigating impacts by petroleum industries on burrowing owls and other prairie species (Scobie and Faminow, 2000) may be used as a template for future mitigation guidelines (Holroyd et al. 2001). Scobie and Faminow (2000) developed guidelines for activities around occupied burrowing owl nests recommending buffers around low, medium, and high disturbance activities, respectively (see below).

Recommended restricted activity dates and setback distances by level of disturbance for burrowing owls (Scobie and Faminow 2000).

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

* meters (m)

Based on existing vegetation, human development, and land uses in an area, resource managers may decide to allow human development or resource extraction closer to these area/sites than recommended above. However, if it is decided to allow activities closer than the setback distances recommended, a broad-scale, long-term, scientifically-rigorous monitoring program ensures that burrowing owls are not detrimentally affected by alternative approaches.

Other minimization measures include eliminating actions that reduce burrowing owl forage and burrowing surrogates (e.g. ground squirrel), or introduce/facilitate burrowing owl predators. Actions that could influence these factors include reducing livestock grazing rates and/or changing the timing or duration of grazing or vegetation management that could result in less suitable habitat.

Burrow exclusion and closure. Burrow exclusion is a technique of installing one-way doors in burrow openings during the non-breeding season to temporarily exclude burrowing owls, or permanently exclude burrowing owls and close burrows after verifying burrows are empty by site monitoring and scoping. Exclusion in and of itself is not a take avoidance, minimization or mitigation method. Eviction of burrowing owls is a potentially significant impact under CEQA.

The long-term demographic consequences of these techniques have not been thoroughly evaluated, and the fate of evicted or excluded burrowing owls has not been systematically studied. Because burrowing owls are dependent on burrows at all times of the year for survival and/or reproduction, evicting them from nesting, roosting, and satellite burrows may lead to indirect impacts or take. Temporary or permanent closure of burrows may result in significant loss of burrows and habitat for reproduction and other life history requirements. Depending on the proximity and availability of alternate habitat, loss of access to burrows will likely result in varying levels of increased stress on burrowing owls and could depress reproduction, increase predation, increase energetic costs, and introduce risks posed by having to find and compete for available burrows. Therefore, exclusion and burrow closure are not recommended where they can be avoided. The current scientific literature indicates consideration of all possible avoidance and minimization measures before temporary or permanent exclusion and closure of burrows is implemented, in order to avoid take.

The results of a study by Trulio (1995) in California showed that burrowing owls passively displaced from their burrows were quickly attracted to adjacent artificial burrows at five of six passive relocation sites. The successful sites were all within 75 meters (m) of the destroyed burrow, a distance generally within a pair's territory. This researcher discouraged using passive relocation to artificial burrows as a mitigation measure for lost burrows without protection of adjacent foraging habitat. The study results indicated artificial burrows were used by evicted burrowing owls when they were approximately 50-100 m from the natural burrow (Thomsen 1971, Haug and Oliphant 1990). Locating artificial or natural burrows more than 100 m from the eviction burrow may greatly reduce the chances that new burrows will be used. Ideally, exclusion and burrow closure is employed only where there are adjacent natural burrows and non-impacted, sufficient habitat for burrowing owls to occupy with permanent protection mechanisms in place. Any new burrowing owl colonizing the project site after the CEQA document has been adopted may constitute changed circumstances that should be addressed in a re-circulated CEQA document.

The current scientific literature indicates that burrow exclusion should only be conducted by qualified biologists (meeting the Biologist's Qualifications above) during the non-breeding season, before breeding behavior is exhibited and after the burrow is confirmed empty by site surveillance and/or scoping. The literature also indicates that when temporary or permanent burrow exclusion and/or burrow closure is implemented, burrowing owls should not be excluded from burrows unless or until:

- A Burrowing Owl Exclusion Plan (see Appendix E) is developed and approved by the applicable local DFG office;
- Permanent loss of occupied burrow(s) and habitat is mitigated in accordance with the Mitigating Impacts sections below. Temporary exclusion is mitigated in accordance with the item #1 under Mitigating Impacts below.
- Site monitoring is conducted prior to, during, and after exclusion of burrowing owls from their burrows sufficient to ensure take is avoided. Conduct daily monitoring for one week to confirm young of the year have fledged if the exclusion will occur immediately after the end of the breeding season.
- Excluded burrowing owls are documented using artificial or natural burrows on an adjoining mitigation site (if able to confirm by band re-sight).

Translocation (Active relocation offsite >100 meters). At this time, there is little published information regarding the efficacy of translocating burrowing owls, and additional research is needed to determine subsequent survival and breeding success (Klute et al. 2003, Holroyd et al. 2001). Study results for translocation in Florida implied that hatching success may be decreased for populations of burrowing owls that undergo translocation (Nixon 2006). At this time, the Department is unable to authorize the capture and relocation of burrowing owls except within the context of scientific research (FGC §1002) or a NCCP conservation strategy.

Mitigating impacts. Habitat loss and degradation from rapid urbanization of farmland in the core areas of the Central and Imperial valleys is the greatest of many threats to burrowing owls in California (Shuford and Gardali, 2008). At a minimum, if burrowing owls have been documented to occupy burrows (see Definitions, Appendix B) at the project site in recent years, the current scientific literature supports the conclusion that the site should be considered occupied and mitigation should be required by the CEQA lead agency to address project-specific significant and cumulative impacts. Other site-specific and regionally significant and cumulative impacts may warrant mitigation. The current scientific literature indicates the following to be best practices. If these best practices cannot be implemented, the lead agency or lead investigator may consult with the Department to develop effective mitigation alternatives. The Department is also available to assist in the identification of suitable mitigation lands.

1. Where habitat will be temporarily disturbed, restore the disturbed area to pre-project condition including decompacting soil and revegetating. Permanent habitat protection may be warranted if there is the potential that the temporary impacts may render a nesting site (nesting burrow and satellite burrows) unsustainable or unavailable depending on the time frame, resulting in reduced survival or abandonment. For the latter potential impact, see the permanent impact measures below.
2. Mitigate for permanent impacts to nesting, occupied and satellite burrows and/or burrowing owl habitat such that the habitat acreage, number of burrows and burrowing owls impacted are replaced based on the information provided in Appendix A. Note: A

minimum habitat replacement recommendation is not provided here as it has been shown to serve as a default, replacing any site-specific analysis and discounting the wide variation in natal area, home range, foraging area, and other factors influencing burrowing owls and burrowing owl population persistence in a particular area.

3. Mitigate for permanent impacts to nesting, occupied and satellite burrows and burrowing owl habitat with (a) permanent conservation of similar vegetation communities (grassland, scrublands, desert, urban, and agriculture) to provide for burrowing owl nesting, foraging, wintering, and dispersal (i.e., during breeding and non-breeding seasons) comparable to or better than that of the impact area, and (b) sufficiently large acreage, and presence of fossorial mammals. The mitigation lands may require habitat enhancements including enhancement or expansion of burrows for breeding, shelter and dispersal opportunity, and removal or control of population stressors. If the mitigation lands are located adjacent to the impacted burrow site, ensure the nearest neighbor artificial or natural burrow clusters are at least within 210 meters (Fisher et al. 2007).
4. Permanently protect mitigation land through a conservation easement deeded to a non-profit conservation organization or public agency with a conservation mission, for the purpose of conserving burrowing owl habitat and prohibiting activities incompatible with burrowing owl use. If the project is located within the service area of a Department-approved burrowing owl conservation bank, the project proponent may purchase available burrowing owl conservation bank credits.
5. Develop and implement a mitigation land management plan to address long-term ecological sustainability and maintenance of the site for burrowing owls (see Management Plan and Artificial Burrow sections below, if applicable).
6. Fund the maintenance and management of mitigation land through the establishment of a long-term funding mechanism such as an endowment.
7. Habitat should not be altered or destroyed, and burrowing owls should not be excluded from burrows, until mitigation lands have been legally secured, are managed for the benefit of burrowing owls according to Department-approved management, monitoring and reporting plans, and the endowment or other long-term funding mechanism is in place or security is provided until these measures are completed.
8. Mitigation lands should be on, adjacent or proximate to the impact site where possible and where habitat is sufficient to support burrowing owls present.
9. Where there is insufficient habitat on, adjacent to, or near project sites where burrowing owls will be excluded, acquire mitigation lands with burrowing owl habitat away from the project site. The selection of mitigation lands should then focus on consolidating and enlarging conservation areas located outside of urban and planned growth areas, within foraging distance of other conserved lands. If mitigation lands are not available adjacent to other conserved lands, increase the mitigation land acreage requirement to ensure a selected site is of sufficient size. Offsite mitigation may not adequately offset the biological and habitat values impacted on a one to one basis. Consult with the Department when determining offsite mitigation acreages.
10. Evaluate and select suitable mitigation lands based on a comparison of the habitat attributes of the impacted and conserved lands, including but not limited to: type and structure of habitat being impacted or conserved; density of burrowing owls in impacted and conserved habitat; and significance of impacted or conserved habitat to the species range-wide. Mitigate for the highest quality burrowing owl habitat impacted first and foremost when identifying mitigation lands, even if a mitigation site is located outside of

a lead agency's jurisdictional boundary, particularly if the lead agency is a city or special district.

11. Select mitigation lands taking into account the potential human and wildlife conflicts or incompatibility, including but not limited to, human foot and vehicle traffic, and predation by cats, loose dogs and urban-adapted wildlife, and incompatible species management (i.e., snowy plover).
12. Where a burrowing owl population appears to be highly adapted to heavily altered habitats such as golf courses, airports, athletic fields, and business complexes, permanently protecting the land, augmenting the site with artificial burrows, and enhancing and maintaining those areas may enhance sustainability of the burrowing owl population onsite. Maintenance includes keeping lands grazed or mowed with weed-eaters or push mowers, free from trees and shrubs, and preventing excessive human and human-related disturbance (e.g., walking, jogging, off-road activity, dog-walking) and loose and feral pets (chasing and, presumably, preying upon owls) that make the environment uninhabitable for burrowing owls (Wesemann and Rowe 1985, Millsap and Bear 2000, Lincer and Bloom 2007). Items 4, 5 and 6 also still apply to this mitigation approach.
13. If there are no other feasible mitigation options available and a lead agency is willing to establish and oversee a Burrowing Owl Mitigation and Conservation Fund that funds on a competitive basis acquisition and permanent habitat conservation, the project proponent may participate in the lead agency's program.

Artificial burrows. Artificial burrows have been used to replace natural burrows either temporarily or long-term and their long-term success is unclear. Artificial burrows may be an effective addition to in-perpetuity habitat mitigation if they are augmenting natural burrows, the burrows are regularly maintained (i.e., no less than annual, with biennial maintenance recommended), and surrounding habitat patches are carefully maintained. There may be some circumstances, for example at airports, where squirrels will not be allowed to persist and create a dynamic burrow system, where artificial burrows may provide some support to an owl population.

Many variables may contribute to the successful use of artificial burrows by burrowing owls, including pre-existence of burrowing owls in the area, availability of food, predators, surrounding vegetation and proximity, number of natural burrows in proximity, type of materials used to build the burrow, size of the burrow and entrance, direction in which the burrow entrance is facing, slope of the entrance, number of burrow entrances per burrow, depth of the burrow, type and height of perches, and annual maintenance needs (Belthoff and King 2002, Smith et al. 2005, Barclay et al. 2011). Refer to Barclay (2008) and (2011) and to Johnson et al. 2010 (unpublished report) for guidance on installing artificial burrows including recommendations for placement, installation and maintenance.

Any long-term reliance on artificial burrows as natural burrow replacements must include semi-annual to annual cleaning and maintenance and/or replacement (Barclay et al. 2011, Smith and Conway 2005, Alexander et al. 2005) as an ongoing management practice. Alexander et al. (2005), in a study of the use of artificial burrows found that all of 20 artificial burrows needed some annual cleaning and maintenance. Burrows were either excavated by predators, blocked by soil or vegetation, or experienced substrate erosion forming a space beneath the tubing that prevented nestlings from re-entering the burrow.

Mitigation lands management plan. Develop a Mitigation Lands Management Plan for projects that require off-site or on-site mitigation habitat protection to ensure compliance with and effectiveness of identified management actions for the mitigation lands. A suggested outline and related vegetation management goals and monitoring success criteria can be found in Appendix E.

Mitigation Monitoring and Reporting

Verify the compliance with required mitigation measures, the accuracy of predictions, and ensure the effectiveness of all mitigation measures for burrowing owls by conducting follow-up monitoring, and implementing midcourse corrections, if necessary, to protect burrowing owls. Refer to CEQA Guidelines Section 15097 and the CEQA Guidelines for additional guidance on mitigation, monitoring and reporting. Monitoring is qualitatively different from site surveillance; monitoring normally has a specific purpose and its outputs and outcomes will usually allow a comparison with some baseline condition of the site before the mitigation (including avoidance and minimization) was undertaken. Ideally, monitoring should be based on the Before-After Control-Impact (BACI) principle (McDonald et al. 2000) that requires knowledge of the pre-mitigation state to provide a reference point for the state and change in state after the project and mitigation have been implemented.

ACKNOWLEDGEMENTS

We thank Jack Barclay, Jeff Lincer, David Plumpton, Jeff Kidd, Carol Roberts and other reviewers for their valuable comments on this report. We also want to acknowledge all the hard work of the Department team, especially T. Bartlett, K. Riesz, S. Wilson, D. Gifford, D. Mayer, J. Gan, L. Connolly, D. Mayer, A. Donlan, L. Bauer, L. Comrack, D. Lancaster, E. Burkett, B. Johnson, D. Johnston, A. Gonzales, S. Morey and K. Hunting.

REFERENCES

Alexander, A. K., M. R. Sackschewsky, and C. A. Duberstein. 2005. Use of artificial burrows by burrowing owls (athene cunicularia) at the HAMMER Facility on the U.S. Department of Energy Hanford Site. Pacific Northwest National Lab-15414. U.S. Department of Energy, DE-AC05-76RL01830, Richland, Washington, USA.

BIOS. California Department of Fish and Game. The Biogeographic Information Observation System (http://bios.dfg.ca.gov/)

Barclay, J. H. 2008. A simple artificial burrow design for burrowing owls. Journal of Raptor Research. 42: 53-57.

Barclay, J. H. 2012. Albion Environmental, Inc, personal communication.

Barclay, J. H., K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts, editors. 2007. Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003, Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

Barclay, J. H., N. Korfanta, and M. Kauffman. 2011. Long-term population dynamics of a managed burrowing owl colony. Journal of Wildlife Management 75: 1295–1306.

Belthoff, J R., R. A. King. 2002. Nest-site characteristics of burrowing owls (athene cunicularia) in the Snake River Birds of Prey National Conservation Area, Idaho, and applications to artificial burrow installation. Western North American Naturalist 62: 112-119.

Botelho, E. S. 1996. Behavioral ecology and parental care of breeding western burrowing owls (Speotyto cunicularia hupugaea) in southern New Mexico, USA. Dissertation, New Mexico State University, Las Cruces, New Mexico, USA.

Burkett, E. E., and B. S. Johnson. 2007. Development of a conservation strategy for burrowing owls in California. Pages 165-168 *in* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts, editors. Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003, Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

CBOC (California Burrowing Owl Consortium). 1997. Burrowing owl survey protocol and mitigation guidelines. Pages 171-177 *in* Lincer, J. L. and K. Steenhof (editors). 1997. The burrowing owl, its biology and management. Raptor Research Report Number 9.

CDFG (California Department of Fish and Game). 1995. Staff report on burrowing owl mitigation. Unpublished report. Sacramento, California, USA.

CNDDB. California Department of Fish and Game. The California Natural Diversity Database (CNDDB) (http://www.dfg.ca.gov/biogeodata/cnddb/), Sacramento, California, USA.

Catlin, D. H. 2004. Factors affecting within-season and between-season breeding dispersal of Burrowing Owls in California. Thesis, Oregon State University, Corvallis, Oregon, USA

Catlin, D. H., and D. K. Rosenberg. 2006. Nest destruction increases mortality and dispersal of Burrowing Owls in the Imperial Valley, California. Southwest Naturalist 51: 406–409.

Catlin, D. H., D. K. Rosenberg, and K. L. Haley. 2005. The effects of nesting success and mate fidelity on breeding dispersal in burrowing owls. Canadian Journal of Zoology 83:1574–1580.

Conway, C. J., and J. Simon. 2003. Comparison of detection probability associated with burrowing owl survey methods. Journal of Wildlife Management 67: 501-511.

Conway, C. J., V. Garcia, M. D., and K. Hughes. 2008. Factors affecting detection of burrowing owl nests during standardized surveys. Journal of Wildlife Management 72: 688-696.

Coulombe, H. N. 1971. Behavior and population ecology of the burrowing owl, Speotyto cunicularia, in the Imperial Valley of California. Condor 73: 162–176.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, P. A. Rabie, and B. R. Euliss. 2003. Effects of management practices on grassland birds: burrowing owl. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/literatr/grasbird/buow/buow.htm>.

DeSante, D. F., E. D Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of burrowing owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1-41 *in* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts, editors. Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003 Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

Desmond, M. J., and J. A. Savidge. 1998. Burrowing Owl conservation in the Great Plains. Proceedings of the Second International Burrowing Owl Symposium, 29-30 September 1999, Ogden, Utah, USA.

Desmond, M. J., and J. A. Savidge. 1999. Satellite burrow use by burrowing owl chicks and its influence on nest fate. Pages 128-130 *in* P. D. Vickery and J. R. Herkert, editors. Ecology and conservation of grassland birds of the western hemisphere. Studies in Avian Biology 19.

Emlen, J. T. 1977. Estimating breeding season bird densities from transects counts. Auk 94: 455-468.

Fisher, J. B., L. A. Trulio, G. S. Biging, and D. Chromczack. 2007. An analysis of spatial clustering and implications for wildlife management: a burrowing owl example. Environmental Management 39: 403-11.

Gervais, J. A., D. K. Rosenberg, and L. A. Comrack. Burrowing Owl (Athene cunicularia) *in* Shuford, W.D. and T. Gardali, editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento, California, USA.

Gervais, J. A., D. K. Rosenberg, R. G. Anthony. 2003. Space use and pesticide exposure risk of male burrowing owls in an agricultural landscape. Journal of Wildlife Management 67: 155-164.

Green, G.A.; Anthony, R.G. 1989. Nesting success and habitat relationships of burrowing owls in the Columbia Basin, Oregon. The Condor 91: 347-354.

Haug, E. A. 1985. Observations on the breeding ecology of burrowing owls in Saskatchewan.

Thesis, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.
Haug, E. A., B. A. Millsap, and M. S. Martell. 1993. Burrowing owl (Speotyto cunicularia), *in* A. Poole and F. Gill, editors, The Birds of North America, The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C., USA.
Haug, E. A., and L. W. Oliphant. 1990. Movements, activity patterns, and habitat use of burrowing owls in Saskatchewan. Journal of Wildlife Management 54: 27-35.
Holroyd, G. L., R. Rodriguez-Estrella, and S. R. Sheffield. 2001. Conservation of the burrowing owl in western North America: issues, challenges, and recommendations. Journal of Raptor Research 35: 399-407.
James, P. C., T. J. Ethier, and M. K. Toutloff. 1997. Parameters of a declining burrowing owl population in Saskatchewan. Pages 34-37. *in* J. L. Lincer, and K. Steenhof, editors. The burrowing owl, its biology and management: including the proceedings of the first international symposium. 13-14 November 1992, Bellevue, WA, USA. Raptor Research Report Number 9.
Johnson, D. H., D. C. Gillis, M. A. Gregg, J. L.Rebholz, J. L. Lincer, and J. R. Belthoff. 2010. Users guide to installation of artificial burrows for burrowing owls. Unpublished report. Tree Top Inc., Selah, Washington, USA.
Klute, D. S., A. W. Ayers, M. T. Green, W. H. Howe, S. L Jones, J. A. Shaffer, S. R. Sheffield, and T. S. Zimmerman. 2003. Status assessment and conservation plan for the western burrowing owl in the United States. U.S. Department of the Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C, USA.
Koenig, W. D., D. D. Van Vuren, and P. N. Hooge. 1996. Detectability, philopatry, and the distribution of dispersal distances in vertebrates. Trends in Ecology and Evolution 11: 514–517.
LaFever, D. H., K. E. LaFever, D. H. Catlin, and D. K. Rosenberg. 2008. Diurnal time budget of burrowing owls in a resident population during the non-breeding season. Southwestern Naturalist 53: 29-33.
Lincer, J. L., and P. W. Bloom. 2007. The status of the burrowing owl (Athene cunicularia) in San Diego County, CA. Pages 90-102 *in* Proceedings of the California Burrowing Owl Symposium, 11-12 November 2003, Sacramento, California, USA. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.
Lutz, R. S. and D. L. Plumpton. 1999. Philopatry and nest site reuse by burrowing owls: implications for management. Journal of Raptor Research 33: 149-153.
MacCracken, J. G., D. W. Uresk, and R. M. Hansen. 1985a. Vegetation and soils of burrowing owl nest sites in Conata Basin, South Dakota. Condor 87: 152-154.
Manning, J. A., and R. S. A. Kaler. 2011. Effects of survey methods on burrowing owl behaviors. Journal of Wildlife Management 75: 525-30.
McDonald, T. L., W. P. Erickson, and L. L. McDonald. 2000. Analysis of count data from before-after control-impact studies. Journal of Agricultural, Biological and Environmental Statistics 5: 262-279.
Millsap, B. A., and C. Bear. 2000. Density and reproduction of burrowing owls along an urban development gradient. Journal of Wildlife Management 64:33-41.
Nixon, P A. 2006. Effects of translocation on the Florida burrowing owl (Athene cunicularia floridana). Thesis. University of South Florida, Tampa, Florida, USA.
Noss, R. F., M. A. O'Connell, and D. D. Murphy. 1997. The science of conservation planning:

habitat conservation under the Endangered Species Act. Island Press, Washington D.C., USA.

Postovit, H. R., and B. C. Postovit. 1987. Impacts and mitigation techniques. Pages 183-213 in Raptor management techniques manual scientific technical series number 10, National Wildlife Federation, Washington, D. C., USA

Remsen, J. V., Jr. 1978. Bird species of special concern in California: An annotated list of declining or vulnerable bird species. California Department of Fish and Game, Nongame Wildlife. Investigations, Wildlife Management Branch Administrative Report 78-1, Sacramento, California, USA.

Rich, T. 1984. Monitoring burrowing owl populations: implications of burrow re-use. Wildlife Society Bulletin 12: 178-189.

Richardson, C. T. and C. K. Miller. 1997. Recommendations for protecting raptors from human disturbance: a review. Wildlife Society Bulletin 25: 634-38.

Ronan, N. A. 2002. Habitat selection, reproductive success, and site fidelity of burrowing owls in a grassland ecosystem. Thesis, Oregon State University, Corvallis, Oregon, USA.

Rosenberg, D., 2009 Oregon State University, Corvallis, personal communication.

Rosenberg, D. K., J. A. Gervais, D. F. DeSante, and H. Ober. 2009. An updated adaptive management plan for the burrowing owl population at NAS Lemoore. The Oregon Wildlife Institute, Corvallis, OR and The Institute for Bird Populations, Point Reyes Station, CA. OWI Contribution No. 201 and IBP Contribution No. 375.

Rosenberg, D. K., J. A. Gervais, H. Ober, and D. F. DeSante. 1998. An adaptive management plan for the burrowing owl population at Naval Air Station Lemoore, California, USA. Publication 95, Institute for Bird Populations, P.O. Box 1346, Pt. Reyes Station, CA 94956.

Rosenberg, D. K., and K. L. Haley. 2004. The ecology of burrowing owls in the agroecosystem of the Imperial Valley, California. Studies in Avian Biology 27:120-135.

Rosenberg, D. K., L. A. Trulio, D. H. Catlin, D. Chromczack, J. A. Gervais, N. Ronan, and K. A. Haley. 2007. The ecology of the burrowing owl in California, unpublished report to Bureau of Land Management.

Rosier, J. R., N. A., Ronan, and D. K. Rosenberg. 2006. Post-breeding dispersal of burrowing owls in an extensive California grassland. American Midland Naturalist 155: 162–167.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. A manual of California vegetation, Second edition. California Native Plant Society, Sacramento, California, USA.

Scobie, D., and C. Faminow. 2000. Development of standardized guidelines for petroleum industry activities that affect COSEWIC Prairie and Northern Region vertebrate species at risk. Environment Canada, Prairie and Northern Region, Edmonton, Alberta, Canada.

Shuford, W. D. and T. Gardali, editors. 2008. California Bird Species of Special Concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento. Gervais, J. A., D. K. Rosenberg, and L. Comrack. 2008. Burrowing Owl (Athene cunicularia).

Smith, M. D., C. J. Conway, and L. A. Ellis. 2005. Burrowing owl nesting productivity: a comparison between artificial and natural burrows on and off golf courses. Wildlife Society Bulletin 33: 454-462.

Thelander, C. G., K. S. Smallwood, and L. Rugge. 2003. Bird risk behaviors and fatalities at the Altamont Pass Wind Resource Area, period of performance: March 1998–

December 2000. U.S. Department of Energy, National Renewable Energy Laboratory, Golden, Colorado, USA.

Thomsen, L. 1971. Behavior and ecology of burrowing owls on the Oakland Municipal Airport. Condor 73: 177-192.

Thompson, C. D. 1984. Selected aspects of burrowing owl ecology in central Wyoming. Thesis, University of Wyoming, Laramie, Wyoming, USA.

Trulio, L. 1995. Passive relocation: A method to preserve burrowing owls on disturbed sites. Journal of Field Ornithology 66: 99–106.

U.S. Fish and Wildlife Service (USFWS). 2002. Birds of conservation concern 2002. U.S. Department of Interior, Division of Migratory Bird Management, Arlington, Virginia, USA.

U.S. Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. U.S. Department of Interior, Division of Migratory Bird Management, Arlington, Virginia, USA.

Wesemann, T. and M. Rowe. 1985. Factors influencing the distribution and abundance of burrowing owls in Cape Coral, Florida. Pages 129-137 *in* L. W. Adams and D. L. Leedy, editors. Integrating Man and Nature in the Metropolitan Environment. Proceedings National Symposium. on Urban Wildlife, 4-7 November 1986, Chevy Chase, Maryland, USA.

Wilkerson, R. L. and R. B. Siegel. 2010. Assessing changes in the distribution and abundance of burrowing owls in California, 1993-2007. Bird Populations 10: 1-36.

Zarn, M. 1974. Burrowing owl. U.S. Department of the Interior, Bureau of Land Management. Technical Note T-N-250, Denver, Colorado, USA.

Appendix A. Burrowing Owl Natural History and Threats

Diet

Burrowing owl diet includes arthropods, small rodents, birds, amphibians, reptiles, and carrion (Haug et al. 1993).

Breeding

In California, the breeding season for the burrowing owl typically occurs between 1 February and 31 August although breeding in December has been documented (Thompson 1971, Gervais et al. 2008); breeding behavior includes nest site selection by the male, pair formation, copulation, egg laying, hatching, fledging, and post-fledging care of young by the parents. The peak of the breeding season occurs between 15 April and 15 July and is the period when most burrowing owls have active nests (eggs or young). The incubation period lasts 29 days (Coulombe 1971) and young fledge after 44 days (Haug et al. 1993). Note that the timing of nesting activities may vary with latitude and climatic conditions. Burrowing owls may change burrows several times during the breeding season, starting when nestlings are about three weeks old (Haug et al. 1993).

Dispersal

The following discussion is an excerpt from Gervais et al (2008):

> "The burrowing owl is often considered a sedentary species (e.g., Thomsen 1971). A large proportion of adults show strong fidelity to their nest site from year to year, especially where resident, as in Florida (74% for females, 83% for males; Millsap and Bear 1997). In California, nest-site fidelity rates were 32%–50% in a large grassland and 57% in an agricultural environment (Ronan 2002, Catlin 2004, Catlin et al. 2005). Differences in these rates among sites may reflect differences in nest predation rates (Catlin 2004, Catlin et al. 2005). Despite the high nest fidelity rates, dispersal distances may be considerable for both juveniles (natal dispersal) and adults (postbreeding dispersal), but this also varied with location (Catlin 2004, Rosier et al. 2006). Distances of 53 km to roughly 150 km have been observed in California for adult and natal dispersal, respectively (D. K. Rosenberg and J. A. Gervais, unpublished data), despite the difficulty in detecting movements beyond the immediate study area (Koenig et al. 1996)."

Habitat

The burrowing owl is a small, long-legged, ground-dwelling bird species, well-adapted to open, relatively flat expanses. In California, preferred habitat is generally typified by short, sparse vegetation with few shrubs, level to gentle topography and well-drained soils (Haug et al. 1993). Grassland, shrub steppe, and desert are naturally occurring habitat types used by the species. In addition, burrowing owls may occur in some agricultural areas, ruderal grassy fields, vacant lots and pastures if the vegetation structure is suitable and there are useable burrows and foraging habitat in proximity (Gervais et al 2008). Unique amongst North

American raptors, the burrowing owl requires underground burrows or other cavities for nesting during the breeding season and for roosting and cover, year round. Burrows used by the owls are usually dug by other species termed host burrowers. In California, California ground squirrel (*Spermophilus beecheyi*) and round-tailed ground squirrel (*Citellus tereticaudus*) burrows are frequently used by burrowing owls but they may use dens or holes dug by other fossorial species including badger (*Taxidea taxus*), coyote (*Canis latrans*), and fox (e.g., San Joaquin kit fox, *Vulpes macrotis mutica*; Ronan 2002). In some instances, owls have been known to excavate their own burrows (Thompson 1971, Barclay 2007). Natural rock cavities, debris piles, culverts, and pipes also are used for nesting and roosting (Rosenberg et al. 1998). Burrowing owls have been documented using artificial burrows for nesting and cover (Smith and Belthoff, 2003).

Foraging habitat. Foraging habitat is essential to burrowing owls. The following discussion is an excerpt from Gervais et al. (2008):

> "Useful as a rough guide to evaluating project impacts and appropriate mitigation for burrowing owls, adult male burrowing owls home ranges have been documented (calculated by minimum convex polygon) to comprise anywhere from 280 acres in intensively irrigated agroecosystems in Imperial Valley (Rosenberg and Haley 2004) to 450 acres in mixed agricultural lands at Lemoore Naval Air Station, CA (Gervais et al. 2003), to 600 acres in pasture in Saskatchewan, Canada (Haug and Oliphant 1990). But owl home ranges may be much larger, perhaps by an order of magnitude, in non-irrigated grasslands such as at Carrizo Plain, California (Gervais et al. 2008), based on telemetry studies and distribution of nests. Foraging occurs primarily within 600 m of their nests (within approximately 300 acres, based on a circle with a 600 m radius) during the breeding season."

Importance of burrows and adjacent habitat. Burrows and the associated surrounding habitat are essential ecological requisites for burrowing owls throughout the year and especially during the breeding season. During the non-breeding season, burrowing owls remain closely associated with burrows, as they continue to use them as refuge from predators, shelter from weather and roost sites. Resident populations will remain near the previous season's nest burrow at least some of the time (Coulombe 1971, Thomsen 1971, Botelho 1996, LaFever et al. 2008).

In a study by Lutz and Plumpton (1999) adult males and females nested in formerly used sites at similar rates (75% and 63%, respectively) (Lutz and Plumpton 1999). Burrow fidelity has been reported in some areas; however, more frequently, burrowing owls reuse traditional nesting areas without necessarily using the same burrow (Haug et al. 1993, Dechant et al. 1999). Burrow and nest sites are re-used at a higher rate if the burrowing owl has reproduced successfully during the previous year (Haug et al. 1993) and if the number of burrows isn't limiting nesting opportunity.

Burrowing owls may use "satellite" or non-nesting burrows, moving young at 10-14 days, presumably to reduce risk of predation (Desmond and Savidge 1998) and possibly to avoid nest parasites (Dechant et al. 1999). Successful nests in Nebraska had more active satellite burrows within 75 m of the nest burrow than unsuccessful nests (Desmond and Savidge

1999). Several studies have documented the number of satellite burrows used by young and adult burrowing owls during the breeding season as between one and 11 burrows with an average use of approximately five burrows (Thompsen 1984, Haug 1985, Haug and Oliphant 1990). Supporting the notion of selecting for nest sites near potential satellite burrows, Ronan (2002) found burrowing owl families would move away from a nest site if their satellite burrows were experimentally removed through blocking their entrance.

Habitat adjacent to burrows has been documented to be important to burrowing owls. Gervais et al. (2003) found that home range sizes of male burrowing owls during the nesting season were highly variable within but not between years. Their results also suggested that owls concentrate foraging efforts within 600 meters of the nest burrow, as was observed in Canada (Haug and Oliphant 1990) and southern California (Rosenberg and Haley 2004). James et al. (1997), reported habitat modification factors causing local burrowing owl declines included habitat fragmentation and loss of connectivity.

In conclusion, the best available science indicates that essential habitat for the burrowing owl in California must include suitable year-round habitat, primarily for breeding, foraging, wintering and dispersal habitat consisting of short or sparse vegetation (at least at some time of year), presence of burrows, burrow surrogates or presence of fossorial mammal dens, well-drained soils, and abundant and available prey within close proximity to the burrow.

Threats to Burrowing Owls in California

Habitat loss. Habitat loss, degradation, and fragmentation are the greatest threats to burrowing owls in California. According to DeSante et al. (2007), “the vast majority of burrowing owls [now] occur in the wide, flat lowland valleys and basins of the Imperial Valley and Great Central Valley [where] for the most part,...the highest rates of residential and commercial development in California are occurring.” Habitat loss from the State’s long history of urbanization in coastal counties has already resulted in either extirpation or drastic reduction of burrowing owl populations there (Gervais et al. 2008). Further, loss of agricultural and other open lands (such as grazed landscapes) also negatively affect owl populations. Because of their need for open habitat with low vegetation, burrowing owls are unlikely to persist in agricultural lands dominated by vineyards and orchards (Gervais et al. 2008).

Control of burrowing rodents. According to Klute et al. (2003), the elimination of burrowing rodents through control programs is a primary factor in the recent and historical decline of burrowing owl populations nationwide. In California, ground squirrel burrows are most often used by burrowing owls for nesting and cover; thus, ground squirrel control programs may affect owl numbers in local areas by eliminating a necessary resource.

Direct mortality. Burrowing owls suffer direct losses from a number of sources. Vehicle collisions are a significant source of mortality especially in the urban interface and where owls nest alongside roads (Haug et al. 1993, Gervais et al. 2008). Road and ditch maintenance, modification of water conveyance structures (Imperial Valley) and discing to control weeds in fallow fields may destroy burrows (Rosenberg and Haley 2004, Catlin and Rosenberg 2006) which may trap or crush owls. Wind turbines at Altamont Pass Wind Resource Area are known to cause direct burrowing owl mortality (Thelander et al. 2003). Exposure to pesticides may pose a threat to the species but is poorly understood (Klute et al. 2003, Gervais et al. 2008).

Appendix B. Definitions

Some key terms that appear in this document are defined below.

Adjacent habitat means burrowing owl habitat that abuts the area where habitat and burrows will be impacted and rendered non-suitable for occupancy.

Breeding (nesting) season begins as early as 1 February and continues through 31 August (Thomsen 1971, Zarn 1974). The timing of breeding activities may vary with latitude and climatic conditions. The breeding season includes pairing, egg-laying and incubation, and nestling and fledging stages.

Burrow exclusion is a technique of installing one-way doors in burrow openings during the non-breeding season to temporarily exclude burrowing owls or permanently exclude burrowing owls and excavate and close burrows after confirming burrows are empty.

Burrowing owl habitat generally includes, but is not limited to, short or sparse vegetation (at least at some time of year), presence of burrows, burrow surrogates or presence of fossorial mammal dens, well-drained soils, and abundant and available prey.

Burrow surrogates include culverts, piles of concrete rubble, piles of soil, burrows created along soft banks of ditches and canals, pipes, and similar structures.

Civil twilight - Morning civil twilight begins when the geometric center of the sun is 6 degrees below the horizon (civil dawn) and ends at sunrise. Evening civil twilight begins at sunset and ends when the geometric center of the sun reaches 6 degrees below the horizon (civil dusk). During this period there is enough light from the sun that artificial sources of light may not be needed to carry on outdoor activities. This concept is sometimes enshrined in laws, for example, when drivers of automobiles must turn on their headlights (called lighting-up time in the UK); when pilots may exercise the rights to fly aircraft. Civil twilight can also be described as the limit at which twilight illumination is sufficient, under clear weather conditions, for terrestrial objects to be clearly distinguished; at the beginning of morning civil twilight, or end of evening civil twilight, the horizon is clearly defined and the brightest stars are visible under clear atmospheric conditions.

Conservation for burrowing owls may include but may not be limited to protecting remaining breeding pairs or providing for population expansion, protecting and enhancing breeding and essential habitat, and amending or augmenting land use plans to stabilize populations and other specific actions to avoid the need to list the species pursuant to California or federal Endangered Species Acts.

Contiguous means connected together so as to form an uninterrupted expanse in space.

Essential habitat includes nesting, foraging, wintering, and dispersal habitat.

Foraging habitat is habitat within the estimated home range of an occupied burrow, supports suitable prey base, and allows for effective hunting.

Host burrowers include ground squirrels, badgers, foxes, coyotes, gophers etc.

Locally significant species is a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (CEQA §15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or occurring in a unique habitat type.

Non-breeding season is the period of time when nesting activity is not occurring, generally September 1 through January 31, but may vary with latitude and climatic conditions.

Occupied site or occupancy means a site that is assumed occupied if at least one burrowing owl has been observed occupying a burrow within the last three years (Rich 1984). Occupancy of suitable burrowing owl habitat may also be indicated by owl sign including its molted feathers, cast pellets, prey remains, eggshell fragments, or excrement at or near a burrow entrance or perch site.

Other impacting activities may include but may not be limited to agricultural practices, vegetation management and fire control, pest management, conversion of habitat from rangeland or natural lands to more intensive agricultural uses that could result in "take". These impacting activities may not meet the definition of a project under CEQA.

Passive relocation is a technique of installing one-way doors in burrow openings to temporarily or permanently evict burrowing owls and prevent burrow re-occupation.

Peak of the breeding season is between 15 April and 15 July.

Sign includes its tracks, molted feathers, cast pellets (defined as 1-2" long brown to black regurgitated pellets consisting of non-digestible portions of the owls' diet, such as fur, bones, claws, beetle elytra, or feathers), prey remains, egg shell fragments, owl white wash, nest burrow decoration materials (e.g., paper, foil, plastic items, livestock or other animal manure, etc.), possible owl perches, or other items.

Appendix C. Habitat Assessment and Reporting Details

Habitat Assessment Data Collection and Reporting

Current scientific literature indicates that it would be most effective to gather the data in the manner described below when conducting project scoping, conducting a habitat assessment site visit and preparing a habitat assessment report:

1. Conduct at least one visit covering the entire potential project/activity area including areas that will be directly or indirectly impacted by the project. Survey adjoining areas within 150 m (Thomsen 1971, Martin 1973), or more where direct or indirect effects could potentially extend offsite. If lawful access cannot be achieved to adjacent areas, surveys can be performed with a spotting scope or other methods.
2. Prior to the site visit, compile relevant biological information for the site and surrounding area to provide a local and regional context.
3. Check all available sources for burrowing owl occurrence information regionally prior to a field inspection. The CNDDB and BIOS (see References cited) may be consulted for known occurrences of burrowing owls. Other sources of information include, but are not limited to, the Proceedings of the California Burrowing Owl Symposium (Barclay et al. 2007), county bird atlas projects, Breeding Bird Survey records, eBIRD (http://ebird.org), Gervais et al. (2008), local reports or experts, museum records, and other site-specific relevant information.
4. Identify vegetation and habitat types potentially supporting burrowing owls in the project area and vicinity.
5. Record and report on the following information:
    a. A full description of the proposed project, including but not limited to, expected work periods, daily work schedules, equipment used, activities performed (such as drilling, construction, excavation, etc.) and whether the expected activities will vary in location or intensity over the project's timeline;
    b. A regional setting map, showing the general project location relative to major roads and other recognizable features;
    c. A detailed map (preferably a USGS topo 7.5' quad base map) of the site and proposed project, including the footprint of proposed land and/or vegetation-altering activities, base map source, identifying topography, landscape features, a north arrow, bar scale, and legend;
    d. A written description of the biological setting, including location (Section, Township, Range, baseline and meridian), acreage, topography, soils, geographic and hydrologic characteristics, land use and management history on and adjoining the site (i.e., whether it is urban, semi-urban or rural; whether there is any evidence of past or current livestock grazing, mowing, disking, or other vegetation management activities);
    e. An analysis of any relevant, historical information concerning burrowing owl use or occupancy (breeding, foraging, over-wintering) on site or in the assessment area;
    f. Vegetation type and structure (using Sawyer et al. 2009), vegetation height, habitat types and features in the surrounding area plus a reasonably sized (as supported with logical justification) assessment area; (Note: use caution in discounting habitat based on grass height as it can be a temporary condition variable by season and conditions (such as current grazing regime) or may be distributed as a mosaic).

g. The presence of burrowing owl individuals or pairs or sign (see Appendix B);
h. The presence of suitable burrows and/or burrow surrogates (>11 cm in diameter (height and width) and >150 cm in depth) (Johnson et al. 2010), regardless of a lack of any burrowing owl sign and/or burrow surrogates; and burrowing owls and/or their sign that have recently or historically (within the last 3 years) been identified on or adjacent to the site.

Appendix D. Breeding and Non-breeding Season Surveys and Reports

Current scientific literature indicates that it is most effective to conduct breeding and non-breeding season surveys and report in the manner that follows:

Breeding Season Surveys

Number of visits and timing. Conduct 4 survey visits: 1) at least one site visit between 15 February and 15 April, and 2) a minimum of three survey visits, at least three weeks apart, between 15 April and 15 July, with at least one visit after 15 June. Note: many burrowing owl migrants are still present in southwestern California during mid-March, therefore, exercise caution in assuming breeding occupancy early in the breeding season.

Survey method. Rosenberg et al. (2007) confirmed walking line transects were most effective in smaller habitat patches. Conduct surveys in all portions of the project site that were identified in the Habitat Assessment and fit the description of habitat in Appendix A. Conduct surveys by walking straight-line transects spaced 7 m to 20 m apart, adjusting for vegetation height and density (Rosenberg et al. 2007). At the start of each transect and, at least, every 100 m, scan the entire visible project area for burrowing owls using binoculars. During walking surveys, record all potential burrows used by burrowing owls as determined by the presence of one or more burrowing owls, pellets, prey remains, whitewash, or decoration. Some burrowing owls may be detected by their calls, so observers should also listen for burrowing owls while conducting the survey.

Care should be taken to minimize disturbance near occupied burrows during all seasons and not to “flush” burrowing owls especially if predators are present to reduce any potential for needless energy expenditure or burrowing owl mortality. Burrowing owls may flush if approached by pedestrians within 50 m (Conway et al. 2003). If raptors or other predators are present that may suppress burrowing owl activity, return at another time or later date for a follow-up survey.

Check all burrowing owls detected for bands and/or color bands and report band combinations to the Bird Banding Laboratory (BBL). Some site-specific variations to survey methods discussed below may be developed in coordination with species experts and Department staff.

Weather conditions. Poor weather may affect the surveyor’s ability to detect burrowing owls, therefore, avoid conducting surveys when wind speed is >20 km/hr, and there is precipitation or dense fog. Surveys have greater detection probability if conducted when ambient temperatures are >20º C, <12 km/hr winds, and cloud cover is <75% (Conway et al. 2008).

Time of day. Daily timing of surveys varies according to the literature, latitude, and survey method. However, surveys between morning civil twilight and 10:00 AM and two hours before sunset until evening civil twilight provide the highest detection probabilities (Barclay pers. comm. 2012, Conway et al. 2008).

Alternate methods. If the project site is large enough to warrant an alternate method, consult current literature for generally accepted survey methods and consult with the Department on the proposed survey approach.

Additional breeding season site visits. Additional breeding season site visits may be necessary, especially if non-breeding season exclusion methods are contemplated. Detailed information, such as approximate home ranges of each individual or of family units, as well as foraging areas as related to the proposed project, will be important to document for evaluating impacts, planning avoidance measure implementation and for mitigation measure performance monitoring.

Adverse conditions may prevent investigators from determining presence or occupancy. Disease, predation, drought, high rainfall or site disturbance may preclude presence of burrowing owls in any given year. Any such conditions should be identified and discussed in the survey report. Visits to the site in more than one year may increase the likelihood of detection. Also, visits to adjacent known occupied habitat may help determine appropriate survey timing.

Given the high site fidelity shown by burrowing owls (see Appendix A, Importance of burrows), conducting surveys over several years may be necessary when project activities are ongoing, occur annually, or start and stop seasonally. (See Negative surveys).

Non-breeding Season Surveys

If conducting non-breeding season surveys, follow the methods described above for breeding season surveys, but conduct at least four (4) visits, spread evenly, throughout the non-breeding season. Burrowing owl experts and local Department staff are available to assist with interpreting results.

Negative Surveys

Adverse conditions may prevent investigators from documenting presence or occupancy. Disease, predation, drought, high rainfall or site disturbance may preclude presence of burrowing owl in any given year. Discuss such conditions in the Survey Report. Visits to the site in more than one year increase the likelihood of detection and failure to locate burrowing owls during one field season does not constitute evidence that the site is no longer occupied, particularly if adverse conditions influenced the survey results. Visits to other nearby known occupied sites can affirm whether the survey timing is appropriate.

Take Avoidance Surveys

Field experience from 1995 to present supports the conclusion that it would be effective to complete an initial take avoidance survey no less than 14 days prior to initiating ground disturbance activities using the recommended methods described in the Detection Surveys section above. Implementation of avoidance and minimization measures would be triggered by positive owl presence on the site where project activities will occur. The development of avoidance and minimization approaches would be informed by monitoring the burrowing owls.

Burrowing owls may re-colonize a site after only a few days. Time lapses between project activities trigger subsequent take avoidance surveys including but not limited to a final survey conducted within 24 hours prior to ground disturbance.

Survey Reports

Report on the survey methods used and results including the information described in the Summary Report and include the reports within the CEQA documentation:

1. Date, start and end time of surveys including weather conditions (ambient temperature, wind speed, percent cloud cover, precipitation and visibility);
2. Name(s) of surveyor(s) and qualifications;
3. A discussion of how the timing of the survey affected the comprehensiveness and detection probability;
4. A description of survey methods used including transect spacing, point count dispersal and duration, and any calls used;
5. A description and justification of the area surveyed relative to the project area;
6. A description that includes: number of owls or nesting pairs at each location (by nestlings, juveniles, adults, and those of an unknown age), number of burrows being used by owls, and burrowing owl sign at burrows. Include a description of individual markers, such as bands (numbers and colors), transmitters, or unique natural identifying features. If any owls are banded, request documentation from the BBL and bander to report on the details regarding the known history of the banded burrowing owl(s) (age, sex, origins, whether it was previously relocated) and provide with the report if available;
7. A description of the behavior of burrowing owls during the surveys, including feeding, resting, courtship, alarm, territorial defense, and those indicative of parents or juveniles;
8. A list of possible burrowing owl predators present and documentation of any evidence of predation of owls;
9. A detailed map (1:24,000 or closer to show details) showing locations of all burrowing owls, potential burrows, occupied burrows, areas of concentrated burrows, and burrowing owl sign. Locations documented by use of global positioning system (GPS) coordinates must include the datum in which they were collected. The map should include a title, north arrow, bar scale and legend;
10. Signed field forms, photos, etc., as appendices to the field survey report;
11. Recent color photographs of the proposed project or activity site; and
12. Original CNDDB Field Survey Forms should be sent directly to the Department's CNDDB office, and copies should be included in the environmental document as an appendix. (http://www.dfg.ca.gov/bdb/html/cnddb.html).

Appendix E. Example Components for Burrowing Owl Artificial Burrow and Exclusion Plans

Whereas the Department does not recommend exclusion and burrow closure, current scientific literature and experience from 1995 to present, indicate that the following example components for burrowing owl artificial burrow and exclusion plans, combined with consultation with the Department to further develop these plans, would be effective.

Artificial Burrow Location

If a burrow is confirmed occupied on-site, artificial burrow locations should be appropriately located and their use should be documented taking into consideration:

1. A brief description of the project and project site pre-construction;
2. The mitigation measures that will be implemented;
3. Potential conflicting site uses or encumbrances;
4. A comparison of the occupied burrow site(s) and the artificial burrow site(s) (e.g., vegetation, habitat types, fossorial species use in the area, and other features);
5. Artificial burrow(s) proximity to the project activities, roads and drainages;
6. Artificial burrow(s) proximity to other burrows and entrance exposure;
7. Photographs of the site of the occupied burrow(s) and the artificial burrows;
8. Map of the project area that identifies the burrow(s) to be excluded as well as the proposed sites for the artificial burrows;
9. A brief description of the artificial burrow design;
10. Description of the monitoring that will take place during and after project implementation including information that will be provided in a monitoring report.
11. A description of the frequency and type of burrow maintenance.

Exclusion Plan

An Exclusion Plan addresses the following including but not limited to:

1. Confirm by site surveillance that the burrow(s) is empty of burrowing owls and other species preceding burrow scoping;
2. Type of scope and appropriate timing of scoping to avoid impacts;
3. Occupancy factors to look for and what will guide determination of vacancy and excavation timing (one-way doors should be left in place 48 hours to ensure burrowing owls have left the burrow before excavation, visited twice daily and monitored for evidence that owls are inside and can't escape i.e., look for sign immediately inside the door).
4. How the burrow(s) will be excavated. Excavation using hand tools with refilling to prevent reoccupation is preferable whenever possible (may include using piping to stabilize the burrow to prevent collapsing until the entire burrow has been excavated and it can be determined that no owls reside inside the burrow);
5. Removal of other potential owl burrow surrogates or refugia on site;
6. Photographing the excavation and closure of the burrow to demonstrate success and sufficiency;

7. Monitoring of the site to evaluate success and, if needed, to implement remedial measures to prevent subsequent owl use to avoid take;
8. How the impacted site will continually be made inhospitable to burrowing owls and fossorial mammals (e.g., by allowing vegetation to grow tall, heavy disking, or immediate and continuous grading) until development is complete.

Appendix F. Mitigation Management Plan and Vegetation Management Goals

Mitigation Management Plan

A mitigation site management plan will help ensure the appropriate implementation and maintenance for the mitigation site and persistence of the burrowing owls on the site. For an example to review, refer to Rosenberg et al. (2009). The current scientific literature and field experience from 1995 to present indicate that an effective management plan includes the following:

1. Mitigation objectives;
2. Site selection factors (including a comparison of the attributes of the impacted and conserved lands) and baseline assessment;
3. Enhancement of the conserved lands (enhancement of reproductive capacity, enhancement of breeding areas and dispersal opportunities, and removal or control of population stressors);
4. Site protection method and prohibited uses;
5. Site manager roles and responsibilities;
6. Habitat management goals and objectives:
    a. Vegetation management goals,
        i. Vegetation management tools:
            1. Grazing
            2. Mowing
            3. Burning
            4. Other
    b. Management of ground squirrels and other fossorial mammals,
    c. Semi-annual and annual artificial burrow cleaning and maintenance,
    d. Non-natives control – weeds and wildlife,
    e. Trash removal;
7. Financial assurances:
    a. Property analysis record or other financial analysis to determine long-term management funding,
    b. Funding schedule;
8. Performance standards and success criteria;
9. Monitoring, surveys and adaptive management;
10. Maps;
11. Annual reports.

Vegetation Management Goals

- Manage vegetation height and density (especially in immediate proximity to burrows). Suitable vegetation structure varies across sites and vegetation types, but should generally be at the average effective vegetation height of 4.7 cm (Green and Anthony 1989) and <13 cm average effective vegetation height (MacCracken et al. 1985*a)*.
- Employ experimental prescribed fires (controlled, at a small scale) to manage vegetation structure;

- Vegetation reduction or ground disturbance timing, extent, and configuration should avoid take. While local ordinances may require fire prevention through vegetation management, activities like disking, mowing, and grading during the breeding season can result in take of burrowing owls and collapse of burrows, causing nest destruction. Consult the take avoidance surveys section above for pre-management avoidance survey recommendations;
- Promote natural prey distribution and abundance, especially in proximity to occupied burrows; and
- Promote self-sustaining populations of host burrowers by limiting or prohibiting lethal rodent control measures and by ensuring food availability for host burrowers through vegetation management.

Refer to Rosenberg et al. (2009) for a good discussion of managing grasslands for burrowing owls.

Mitigation Site Success Criteria

In order to evaluate the success of mitigation and management strategies for burrowing owls, monitoring is required that is specific to the burrowing owl management plan. Given limited resources, Barclay et al. (2011) suggests managers focus on accurately estimating annual adult owl populations rather than devoting time to estimating reproduction, which shows high annual variation and is difficult to accurately estimate. Therefore, the key objective will be to determine accurately the number of adult burrowing owls and pairs, and if the numbers are maintained. A frequency of 5-10 years for surveys to estimate population size may suffice if there are no changes in the management of the nesting and foraging habitat of the owls.

Effective monitoring and evaluation of off-site and on-site mitigation management success for burrowing owls includes (Barclay, pers. comm.):

- Site tenacity;
- Number of adult owls present and reproducing;
- Colonization by burrowing owls from elsewhere (by band re-sight);
- Evidence and causes of mortality;
- Changes in distribution; and
- Trends in stressors.

BURROWING OWL SURVEY INSTRUCTIONS
For the
Western Riverside Multiple Species Habitat Conservation Plan Area

PURPOSE OF THE SURVEYS

According to the Multiple Species Habitat Conservation Plan (MSHCP), surveys for the burrowing owl are to be conducted as part of the environmental review process. The MSHCP Additional Surveys Needs and Procedures identify a specific burrowing owl survey area within the MSHCP Plan Area. The MSHCP also identifies species-specific objectives for the burrowing owl, namely species-specific objectives 5 and 6, both of which require burrowing owl surveys if suitable habitat occurs on a proposed project site.

Although the MSHCP references the California Department of Fish and Game Staff report which is based on the Burrowing Owl Consortium Guidelines, the purpose of the following instructions is to clarify the methods necessary to obtain sufficient information to address consistency with; 1) specific conservation requirements of the MSHCP as identified in species-specific Objective 5, and 2) ensure direct mortality of burrowing owls is avoided through implementation of species-specific objective 6 (Pre-construction surveys). Note that surveys conducted to address burrowing owl species-specific objective 5 are necessary during the project design phase while surveys to address species-specific objective 6 are to be conducted just prior to project construction. Habitat assessments and burrowing owl surveys should be conducted by a biologist knowledgeable in burrowing owl habitat, ecology, and field identification of the species and burrowing owl sign.

STEP I: HABITAT ASSESSMENT

Burrowing Owl Habitat Description: Burrowing owls use a variety of natural and modified habitats for nesting and foraging that is typically characterized by low growing vegetation. Burrowing owl habitat includes, but is not limited to, native and non-native grassland, interstitial grassland within shrub lands, shrub lands with low density shrub cover, golf-courses, drainage ditches, earthen berms, unpaved airfields, pastureland, dairies, fallow fields, and agricultural use areas.

Burrowing owls typically use burrows made by fossorial (adapted for burrowing or digging) mammals, such as ground squirrels (*Spermaphilus beecheyi*) or badgers (*Taxidea taxus*), they often utilize manmade structures, such as earthen berms; cement culverts; cement, asphalt, rock, or wood debris piles; or openings beneath cement or asphalt pavement. Burrowing owls are often found within, under, or in close proximity to man-made structures.

The first step in the assessment process is to walk the property to identify the presence of burrowing owl habitat on the project site. If habitat is found on the site, then walk a 150-meter (approximately 500 feet) buffer zone around the project boundary. If permission to access the buffer area cannot be obtained, do not trespass on adjacent property but visually inspect the adjacent habitat areas with binoculars and/or spotting scopes. Habitat assessments that do not include walking the property will not be accepted. Driving by a site and reporting it as disturbed or under agricultural/dairy use is not acceptable.

If burrowing owl habitat occurs on-site, both Step II (focused surveys, census, and mapping) and Preconstruction Surveys are required. If burrows are found during the habitat assessment then suitable habitat is present and Step II is required. However, lack of identifying burrows during the habitat assessment does not negate the need for the systematic search for burrows included as part of the Step II survey instructions. If burrowing owl habitat is not present on-site (i.e. if the site is completely covered by chaparral, cement or asphalt) Step II of the survey is not necessary. No Pre-construction surveys are necessary if there is no suitable habitat on-site.

A written report (with photographs of the site) detailing results of the habitat assessment should be prepared, indicating whether or not the project site contains suitable burrowing owl habitat. Simply reporting that the site is disturbed or under agricultural/dairy use is not acceptable.

STEP II- LOCATING BURROWS AND BURROWING OWLS

Completion of the following will constitute an acceptable burrowing owl survey. A minimum of one site visit must occur, but additional visits may be warranted depending on the results of the first site visit. Surveys conducted during the breeding season March 1 - August 31 are required to describe if, when, and how the site is used by burrowing owls. Negative results during surveys outside the breeding season are not conclusive proof that owls do not use the project site and may not provide an accurate picture of the number of owls that may utilize the site. Surveys that are conducted outside the breeding season will likely need to be repeated during the breeding season; therefore, it is recommended that surveys only be conducted during the breeding season (unless conducting Preconstruction surveys).

All surveys shall be conducted as described in Parts A and B below. Surveys should be conducted during weather that is conducive to observing owls outside their burrows and detecting burrowing owl sign. Surveys will not be accepted if they are conducted during rain, high winds (> 20 mph), dense fog, or temperatures over 90 °F. Part B surveys should be conducted in the morning one hour before sunrise to two hours after sunrise or in the early evening two hours before sunset to one hour after sunset. Count and map all burrowing owl sightings, occupied burrows, and burrows with owl sign. Record the location of all owls including numbers of pairs and juveniles and any behavior such as courtship and mating. Map the extent of all suitable habitat. It should be noted that owl sign may not be detectable if surveys under Part A are conducted within 5 days following rain. Absence of burrowing owl sign cannot be used to confirm absence of the species if the focused burrow survey (Part A) is conducted within 5 days of rain; therefore, in this instance, completion of all four focused burrowing owl surveys (Part B) is required.

Part A: Focused Burrow Surveys

A focused burrow survey that includes natural burrows or suitable man-made structures needs to be conducted as described below.

1. A systematic survey for burrows including burrowing owl sign should be conducted by walking through suitable habitat over the entire survey area (i.e. the project site and within 150 meters). Pedestrian survey transects need to be spaced to allow 100% visual coverage of the ground surface.

   The distance between transect center lines should be no more than 30 meters (approximately 100 ft.) and should be reduced to account for differences in terrain, vegetation density, and ground surface visibility. To efficiently survey projects larger than 100 acres, it is recommended that two or more qualified surveyors conduct concurrent surveys.

2. The location of all suitable burrowing owl habitat, potential owl burrows, burrowing owl sign, and any owls observed should be recorded and mapped, including GPS coordinates. If the survey area contains natural or man-made structures that could potentially support burrowing owls, or owls are observed during the burrow surveys, the systematic surveys should continue as prescribed in Part B. If no potential burrows are detected, no further surveys are required. A written report including photographs of the project site, location of burrowing owl habitat surveyed, location of transects, and burrow survey methods should be prepared. If the report indicates further surveys are not required, then the report should state the reason(s) why further focused burrowing owl surveys are not necessary.

Part B: Focused Burrowing Owl Surveys

Focused Burrowing Owl Surveys will consist of site visits on four separate days. The first one may be conducted concurrent with the Focused Burrow Survey.

1. Upon arrival at the survey area and prior to initiating the walking surveys, surveyors using binoculars and/or spotting scopes should scan all suitable habitat, location of mapped burrows, owl sign, and owls, including perch locations to ascertain owl presence. This is particularly important if access has not been granted for adjacent areas with suitable habitat.

2. A survey for owls and owl sign should then be conducted by walking through suitable habitat over the entire project site and within the adjacent 150 m (approx. 500 feet). These “pedestrian surveys” should follow transects (i.e. Survey transects that are spaced to allow 100% visual coverage of the ground surface. The distance between transect center lines should be no more than 30 meters (approx 100 feet.) and should be reduced to account for differences in terrain, vegetation density, and ground surface visibility. To efficiently survey projects larger than 100 acres, it is recommended that two or more qualified surveyors conduct concurrent surveys.) It is important to minimize disturbance near occupied burrows during all seasons.

3. If access is not obtained, then the area adjacent to the project site shall also be surveyed using binoculars and/or spotting scopes to determine if owls are present in areas adjacent to project site. This 150-meter buffer zone is included to fully characterize the population. If the site is determined not to be occupied, no further surveys are required until 30 days prior to grading (see Pre-construction Surveys below).

STEP III: REPORTING REQUIREMENTS

After completion of appropriate surveys, a final report shall be submitted to the Riverside County Environmental Programs Department and the RCA Monitoring Program Administrator, which discusses the survey methodology, transect width, duration, conditions, and results of the survey. Appropriate maps showing burrow locations shall be included.

PRE-CONSTRUCTION SURVEYS

All project sites containing burrows or suitable habitat (based on Step I/Habitat Assessment) whether owls were found or not, require pre-construction surveys that shall be conducted within 30 days prior to ground disturbance to avoid direct take of burrowing owls (MSHCP Species-Specific Objective 6).

SWAPE Technical Consultation, Data Analysis and Litigation Support for the Environment

2656 29th Street, Suite 201
Santa Monica, CA 90405

Matt Hagemann, P.G, C.Hg.
(949) 887-9013
mhagemann@swape.com

Paul E. Rosenfeld, PhD
(310) 795-2335
prosenfeld@swape.com

November 5, 2020

Gary Ho
Blum Collins LLP
707 Wilshire Blvd, Ste. 4880
Los Angeles, CA 90017

Subject: Comments on IDI Rider 2 & 4 High Cube Warehouses and Perris Valley Storm Drain Channel Improvement Project (SCH No. 2019100297)

Dear Mr. Ho,

We have reviewed the September 2020 Draft Environmental Impact Report ("DEIR") for the IDI Rider 2 & 4 High Cube Warehouses and Perris Valley Storm Drain Channel Improvement Project ("Project") located in the City of Perris ("City"). The Project proposes to construct two Class A high cube warehouse buildings, including up to 1,352,736-SF of warehouse and office space; improvements to a portion of the existing PVSD Channel; and replacement of the Rider Street bridge over the PVSD Channel, as well as 514 parking spaces, on the 99.2-acre site.

Our review concludes that the DEIR fails to adequately evaluate the Project's air quality, health risk, and greenhouse gas impacts. As a result, emissions and health risk impacts associated with construction and operation of the proposed Project are underestimated and inadequately addressed. An updated EIR should be prepared and recirculated to adequately assess and mitigate the potential air quality, health risk, and greenhouse gas impacts that the project may have on the surrounding environment.

Air Quality

Unsubstantiated Input Parameters Used to Estimate Project Emissions

The DEIR's air quality analysis relies on emissions calculated with CalEEMod.2016.3.2.[1] CalEEMod provides recommended default values based on site-specific information, such as land use type, meteorological data, total lot acreage, project type and typical equipment associated with project type. If more specific project information is known, the user can change the default values and input project-specific values, but the California Environmental Quality Act ("CEQA") requires that such changes be justified by substantial evidence.[2] Once all of the values are inputted into the model, the Project's construction and operational emissions are calculated, and "output files" are generated. These output files disclose to the reader what parameters were utilized in calculating the Project's air pollutant emissions and make known which default values were changed as well as provide justification for the values selected.[3]

As previously stated, the DEIR's air quality analysis relies on air pollutant emissions calculated using CalEEMod. When reviewing the Project's CalEEMod output files, provided as Attachment 3 to Appendix B, the Air Quality Impact Analysis ("AQIA"), we found that several model inputs were not consistent with information disclosed in the DEIR. As a result, the Project's construction and operational emissions are underestimated. An updated EIR should be prepared and recirculated to include an updated air quality analysis that adequately evaluates the impacts that construction and operation of the Project will have on local and regional air quality.

Unsubstantiated Reduction to the Number of Hauling Trips

Review of the Project's CalEEMod output files demonstrates that the "Perris Valley Storm Drain - Channel Excavation (Construction - Mitigated)" model includes a manual reduction to the default number of hauling trips required for construction (see excerpt below) (Appendix B, Attachment 3.5, pp. 725).

Table Name	Column Name	Default Value	New Value
tblTripsAndVMT	HaulingTripNumber	22,500.00	0.00

As you can see in the excerpt above, the number of hauling trips was manually reduced to 0 in the model. As previously mentioned, the CalEEMod User's Guide requires any changes to model defaults be justified.[4] According to the "User Entered & Comments & Non-Default Data" table for the model, the

---

[1] CAPCOA (November 2017) CalEEMod User's Guide, http://www.aqmd.gov/docs/default-source/caleemod/01_user-39-s-guide2016-3-2_15november2017.pdf?sfvrsn=4.

[2] CAPCOA (November 2017) CalEEMod User's Guide, http://www.aqmd.gov/docs/default-source/caleemod/01_user-39-s-guide2016-3-2_15november2017.pdf?sfvrsn=4, p. 1, 9.

[3] CAPCOA (November 2017) CalEEMod User's Guide, http://www.aqmd.gov/docs/default-source/caleemod/01_user-39-s-guide2016-3-2_15november2017.pdf?sfvrsn=4, p. 11, 12 – 13. A key feature of the CalEEMod program is the "remarks" feature, where the user explains why a default setting was replaced by a "user defined" value. These remarks are included in the report.

[4] CalEEMod User Guide, *available at:* http://www.caleemod.com/, p. 2, 9

justification provided for this change is: "Material will be pushed on-site by Scrapers" (Appendix B, Attachment 3.5, pp. 725). Furthermore, the DEIR states:

> "The soils would be moved from the Channel to the building sites using scrapers, which would eliminate the need for heavy trucks to haul the soil" (p. 1-4).

As the above excerpt demonstrates, soils would be moved from the Channel to the building sites using scrapers instead of heavy trucks. As such, the Project correctly includes scrapers, instead of hauling trucks, in the equipment list for the excavation construction phase (p. 3-53). However, the Project still must account for the number and length of scraper trips used to transport the soil from the Channel to the building sites, which is not accounted for by including scrapers in the Project's off-road construction equipment list. Specifically, according to the CalEEMod User's Guide, emissions associated with off-road construction equipment include emission factor, number of pieces of equipment, horsepower, load factor, hours of operation, and equipment type (see excerpt below).[5]

$$\text{Emission}_{\text{DieselEx}} = \sum_i (\text{EF}_i \times \text{Pop}_i \times \text{AvgHp}_i \times \text{Load}_i \times \text{Activity}_i)$$

Where:

EF = Emission factor in grams per horsepower-hour (g/bhp-hr) as processed from OFFROAD2011

Pop = Population, or the number of pieces of equipment

AvgHp = Maximum rated average horsepower

Load = Load factor

Activity = Hours of operation

i = equipment type

As you can see in the excerpt above, the model does not take into account the number or length of trips when accounting for scrapers. As such, the model should have included hauling trips to account for this. The DEIR fails to mention or provide any information on the number of trips required, and, as a result, we cannot verify the change from the default hauling trip number. This unsubstantiated reduction presents an issue, as the number of hauling trips and associated vehicle miles traveled ("VMT") are used by CalEEMod to determine both the exhaust emissions associated with on-road vehicle use and fugitive dust emissions.[6] Thus, by including ***zero*** hauling trips, the model fails to account for the transport of soil, resulting in an underestimation of the Project's construction-related emissions, and should not be relied upon to determine Project significance.

[5] CalEEMod User Guide, Appendix A, *available at:* http://www.caleemod.com/, p. 7.
[6] CalEEMod User Guide, Appendix A, *available at:* http://www.caleemod.com/, p. 13.

Unsubstantiated Changes to Energy Use Values

Review of the Project's CalEEMod output files demonstrates that the "IDI Rider 2 & 4 and PVSD Improvement (Operations - Unmitigated)" model includes unsubstantiated manual reductions to the Project's anticipated energy use values (see excerpt below) (Appendix B, Attachment 3.5, pp. 1,313)

Table Name	Column Name	Default Value	New Value
tblEnergyUse	LightingElect	1.17	0.82
tblEnergyUse	NT24NG	0.03	0.00
tblEnergyUse	T24E	0.37	0.26
tblEnergyUse	T24NG	2.00	1.40

As you can see in the excerpt above, the lighting electricity ("LightingElect"), Title-24 electricity energy intensity ("T24E"), and Title-24 natural gas energy intensity ("T24NG") values were each manually reduced by 30%, and the Nontitle-24 natural gas energy intensity ("NT24NG") was manually reduced by 100% to zero. As previously mentioned, the CalEEMod User's Guide requires any changes to model defaults be justified.[7] According to the User Entered Comments and Non-Default Data table, the justification provided for these changes is: "The project will design building shells and building components to meet 2019 Title 24 Standards which expects 30% less energy for nonresidential uses" (Appendix B, Attachment 3.5, pp. 1313). However, this justification is insufficient for two reasons. First, while the DEIR indicates that the Project expects a ***30%*** reduction in energy use, the NT24NG value was reduced by ***100%***, from the default value of 0.03- to 0.00- kilo-British thermal unit per size per year ("KBTU/size/year"). Second, simply because the 2019 Title 24 Standards ***expect*** nonresidential land uses to reduce energy use by 30%, does not guarantee that this reduction would occur locally on the Project site. Without any additional information regarding ***how*** the Project would achieve a 30% reduction in energy use, we cannot verify the revised values. This presents an issue, as CalEEMod uses the energy use values to calculate the Project's emissions associated with building electricity and non-hearth natural gas usage.[8] By including unsubstantiated changes to the Project's energy use values, the models may underestimate the Project's energy-related operational emissions and should not be relied upon to determine Project significance.

Use of Underestimated Saturday and Sunday Trip Rates

According to the DEIR, the "Project is estimated to generate a total of approximately 1,926 trip-ends per day" (p. 4.13-21). However, review of the Project's CalEEMod output files demonstrates that the "IDI Rider 2 & 4 and PVSD Improvement (Operations - Unmitigated)" model only includes 1,291.04 Saturday daily trips and 1,194.90 Sunday daily trips (see excerpt below) (Appendix B, Attachment 3.5, pp. 1369).

[7] CalEEMod User Guide, *available at:* http://www.caleemod.com/, p. 2, 9

[8] CalEEMod User Guide, *available at:* http://www.caleemod.com/, p. 43

	Average Daily Trip Rate		
Land Use	Weekday	Saturday	Sunday
Other Asphalt Surfaces	0.00	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00
Parking Lot	0.00	0.00	0.00
Unrefrigerated Warehouse-No Rail	1,922.83	1,291.04	1194.90
Total	1,922.83	1,291.04	1,194.90

As you can see in the excerpt above, the average number of Saturday and Sunday trips are underestimated by approximately 635- and 731-trips, respectively. Thus, the trip rates inputted into the model are underestimated and inconsistent with the information provided by the DEIR. This presents an issue, as CalEEMod uses the trip rates to calculate the emissions associated with operational on-road vehicles.[9] Thus, by including underestimated operational vehicle trip rates, the model underestimates the Project's mobile-source operational emissions and should not be relied upon to determine Project significance.

Unsubstantiated Changes to Operational Vehicle Emission Factors

Review of the Project's CalEEMod output files demonstrates that the operational vehicle emission factors were manually altered in all of the models (Appendix B, Attachment 3.5, pp. 726-769, 842-887, 990-1035, 1314-1362). As previously mentioned, the CalEEMod User's Guide requires any changes to model defaults be justified.[10] According to the User Entered Comments and Non-Default Data table, the justification provided for these changes is: "EMFAC2017" (Appendix B, Attachment 3.5, pp. 725, 841, 989, 1157, 1313). Furthermore, the AQIA states:

> "This AQIA utilizes summer, winter, and annual EMFAC2017 emission factors in order to derive vehicle emissions associated with Project operational activities" (Appendix B, Attachment 3.5 pp. 53).

However, this justification is insufficient, as EMFAC refers to an ***entire database***, not a specific set of vehicle emission factors.[11] Thus, the DEIR and associated documents should have specified either which input parameters were used to obtain the vehicle emission factors inputted in the model, or the reduced vehicle emission factors themselves. Absent the specific input parameters, we cannot verify the altered vehicle emission factors, and the changes may be incorrect. This presents an issue, as CalEEMod uses the vehicle emission factors to calculate the Project's operational emissions associated with on-road vehicles.[12] Thus, by including several unsubstantiated changes to the Project's anticipated vehicle emission factors, the models may underestimate the Project's mobile-related operational emissions and should not be relied upon to determine Project significance.

---

[9] "CalEEMod User's Guide." CAPCOA, November 2017, *available at:* http://www.caleemod.com/, p. 35.
[10] CalEEMod User Guide, *available at:* http://www.caleemod.com/, p. 2, 9
[11] "EMFAC2017 Web Database." CARB, *available at:* https://arb.ca.gov/emfac/2017/.
[12] CalEEMod User Guide, *available at:* http://www.caleemod.com/, p. 35.

Failure to Implement All Feasible Mitigation to Reduce Emissions

The DEIR concludes that the proposed Project would result in a significant and unavoidable air quality impact with respect to construction-related and operational NO_X emissions (p. 5-3). Specifically, regarding the Project's construction-related NO_X emissions, the DEIR states:

> "[A]fter implementation of applicable PVCCSP EIR mitigation measures, emissions resulting from the Project construction would still exceed thresholds established by the SCAQMD for emissions of NO_X… Since neither the Project Applicant nor the City have regulatory authority to control tailpipe emissions, no additional feasible mitigation measures exist that would reduce NO_X emissions to levels that are less than significant, thus NO_X emissions during construction are considered significant and unavoidable. Therefore, the Project would result in a significant and unavoidable cumulatively considerable net increase of a criteria pollutant for which the project region is nonattainment under an applicable federal or State ambient air quality standard" (p. 4.3-26).

Furthermore, in regard to operational NO_X emissions, the DEIR states:

> "[T]he Project would exceed regional thresholds of significance established by the SCAQMD for emissions of NO_X. Over 95 percent of operational-source NO_X emissions would be generated from the mobile activities. As previously stated, the Project is required to comply with the applicable PVCCSP EIR mitigation measures identified above. Additional Project-level mitigation measures also have been identified and are included below (refer to mitigation measures MM 3-1 through MM 3-14). It should be noted that no additional feasible mitigation measures, beyond the measures identified herein, exist that would further reduce these emissions to levels that are less than significant. Neither the Project Applicant nor the Lead Agency (City of Perris) can substantively or materially affect reductions in Project mobile source emissions beyond the regulatory requirements and mitigation measures identified herein. Thus, these emissions are considered significant and unavoidable, consistent with the conclusions of the PVCCSP EIR" (p. 5-3).

However, while we agree that the Project would result in a significant air quality impact, the DEIR's conclusion that these impacts are "significant and unavoidable" is incorrect. According to CEQA Guidelines § 15096(g)(2):

> "When an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment."

As you can see, an impact can only be labeled as significant and unavoidable after *<u>all available, feasible</u>* mitigation is considered. However, while the DEIR claims that "no additional feasible mitigation measures, beyond the measures identified herein, exist that would further reduce these emissions to levels that are less than significant," this is incorrect (p. 4.3-26). Review of the DEIR demonstrates that the document actually fails to implement *<u>all feasible</u>* mitigation. Namely, while the DEIR includes MM Air

6, which requires off-road construction equipment to meet Tier 3 standards, the DEIR fails to acknowledge the possibility of requiring off-road construction equipment to meet the more efficient Tier 4 Interim or Final standards (p. 1-13, Table 1-1). Thus, the DEIR fails to consider *all available, feasible* mitigation, and the significant and unavoidable impact conclusion should not be relied upon. To reduce the Project's air quality impacts to the maximum extent possible, additional feasible mitigation measures should be incorporated, such as those suggested in the section of this letter titled "Feasible Mitigation Measures Available to Reduce Emissions," especially those related to NO_X emissions.[13] Until all feasible mitigation is considered and incorporated into the Project's design, the Project's construction and operational NO_X emissions should not be considered significant and unavoidable.

Diesel Particulate Matter Health Risk Emissions Inadequately Evaluated

The DEIR concludes that the Project's health risk impacts would be less than significant as a result of a quantitative mobile-source health risk assessment ("HRA") and localized significance threshold ("LST") analysis, without conducting quantified construction HRA (p. 4.3-44). Specifically, regarding the Project's localized construction-related emissions, the DEIR states:

> "[L]ocalized emissions resulting from the Project construction would not exceed localized thresholds of significant for emissions of any criteria pollutant. Thus, a less than significant impact would occur for Project-related localized construction-source emissions and no additional mitigation is required beyond compliance with the PVCCSP EIR mitigation measures" (p. 4.3-35).

Furthermore, regarding the omission of a quantified construction HRA, the DEIR states:

> "Given that there is no available guidance that has been adopted by SCAQMD for CEQA purposes and the fact that the Project does not emit any pollutants that elicit a primary mutagenic mode of action, the use of the OEHHA Guidelines to determine potential construction health risks would not be appropriate and therefore has not been conducted. On this basis, Project-related DPM emissions during construction would not expose sensitive receptors to substantial pollutant concentrations, and impacts would be less than significant" (p. 4.3-39 - 4.3-40).

Finally, regarding health risk impacts associated with Project operation, the DEIR states:

> "At the Maximally Exposed Individual Receptor (MEIR), the maximum incremental cancer risk attributable to Project DPM source emissions is estimated at 7.34 in one million, which is less than the SCAQMD's significance threshold of 10 in one million… As such, the Project would not cause a significant human health or cancer risk to adjacent residences" (p. 4.3-44).

As you can see in the excerpt above, the DEIR concludes that the Project's operations would result in a cancer risk of 7.34 in one million, which would not exceed the SCAQMD threshold of 10 in one million.

---

[13] See section titled "Feasible Mitigation Measures Available to Reduce Emissions" below. These measures would effectively reduce the Project's construction-related and operational NO_X emissions.

However, the DEIR's analysis of the Project's health risk impacts, as well as the subsequent less-than-significant impact conclusion, is incorrect for three reasons.

First, the use of the LST method to determine the health risk impacts posed by Project construction to nearby sensitive receptors is incorrect, as this method only evaluates impacts from criteria air pollutants. Specifically, according to the Final Localized Significance Threshold Methodology document prepared by the SCAQMD, the LST analysis is only applicable to NO_x, CO, PM_{10}, and $PM_{2.5}$ emissions, which are collectively referred to as criteria air pollutants.[14] Because the LST method can only be applied to criteria air pollutants, this method cannot be used to determine whether emissions from toxic air contaminants ("TACs"), specifically diesel particulate matter ("DPM"), a known human carcinogen, will result in a significant health risk impact to nearby sensitive receptors. Furthermore, SCAQMD guidance states:

> "Projects that emit toxic air contaminants (TAC) typically undergo an analysis of localized air quality impacts ***relative to cancer and non-cancer health risks***" (emphasis added).[15]

Here, however, health impacts from exposure to TACs, including DPM, resulting from Project construction were not analyzed relative to cancer health risks, thus leaving a gap in the DEIR's analysis.

Second, the omission of a quantified construction HRA is inconsistent with the most recent guidance published by the Office of Environmental Health Hazard Assessment ("OEHHA"), the organization responsible for providing guidance on conducting HRAs in California, as referenced by the DEIR. While the DEIR claims that this guidance is inapplicable, as "the Project does not emit any pollutants that elicit a primary mutagenic mode of action," this does not justify the omission of a construction HRA. Rather, Project construction may produce emissions that would result in an increased cancer risk for nearby sensitive receptors. Specifically, these sources may include vehicle and truck trips to and from the Project site, including excess emissions from idling, generators, and diesel-powered off-road construction equipment.[16] Thus, contrary to claims made in the DEIR, construction of the Project ***will*** produce emissions of DPM, a human carcinogen, through the exhaust stacks of construction equipment, vehicle use, and generators over a construction period of approximately 14 months (p. 1-4). The OEHHA document recommends that all short-term projects lasting at least two months be evaluated for cancer risks to nearby sensitive receptors.[17] Therefore, per OEHHA guidelines, we recommend that health risk impacts from Project construction be evaluated in an updated EIR. These recommendations reflect the most recent health risk policy, as adopted by the air district, and as such, an updated assessment of

---

[14] "Final Localized Significance Threshold Methodology." SCAQMD, Revised July 2008, *available at:* http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/final-lst-methodology-document.pdf.

[15] "Fact Sheet: Localized Significance Thresholds." SCAQMD, *available at:* file:///C:/Users/SWAPE/Downloads/SCAQMD%20LST%20Fact%20Sheet.pdf, p. 2.

[16] "AP 42, Fifth Edition, Volume I Chapter 3.3: Gasoline And Diesel Industrial Engines." Environmental Protection Agency ("EPA"), October 1996, *available at:* https://www3.epa.gov/ttnchie1/ap42/ch03/final/c03s03.pdf.

[17] "Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments." OEHHA, February 2015, *available at:* http://oehha.ca.gov/air/hot_spots/2015/2015GuidanceManual.pdf, p. 8-18

health risks to nearby sensitive receptors from Project construction and operation should be included in an updated EIR for the Project.

Third, review of the DEIR demonstrates that, while the Project did conduct an operational HRA, evaluating the health risk impacts associated with heavy-duty diesel trucks accessing the site, the HRA fails to evaluate the *cumulative* lifetime cancer risk to nearby, existing receptors as a result of Project construction *and* operation *together*. According to OEHHA guidance, "the excess cancer risk is calculated separately for each age grouping and then summed to yield cancer risk at the receptor location."[18] However, the HRA conducted in the DEIR fails to sum each age bin to evaluate the total cancer risk over the course of the Project's *entire* construction and operation. This is incorrect and thus, an updated EIR should quantify the Project's construction and operational cancer risks and sum them to compare to the SCAQMD threshold of 10 in one million, as referenced by the DEIR (p. 4.3-21).[19]

Screening-Level Assessment Indicates Significant Impact

In an effort to demonstrate the potential health risk impacts posed by Project construction and operation to nearby sensitive receptors, we prepared a simple screening-level HRA. The results of our assessment, as described below, provide substantial evidence that the Project's construction and operational DPM emissions may result in a potentially significant health risk impact not previously identified by the DEIR.

In order to conduct our screening level risk assessment, we relied upon AERSCREEN, which is a screening level air quality dispersion model. [20] The model replaced SCREEN3, and AERSCREEN is included in the OEHHA[21] and the California Air Pollution Control Officers Associated ("CAPCOA")[22] guidance as the appropriate air dispersion model for Level 2 health risk screening assessments ("HRSAs"). A Level 2 HRSA utilizes a limited amount of site-specific information to generate maximum reasonable downwind concentrations of air contaminants to which nearby sensitive receptors may be exposed. If an unacceptable air quality hazard is determined to be possible using AERSCREEN, a more refined modeling approach is required prior to approval of the Project.

In an effort to determine the proposed Project's construction emissions and connect these emissions to potential health risk impacts, we prepared an updated CalEEMod model for the Project, using the Project-specific information provided by the DEIR. In our updated construction CalEEMod model, we omitted the unsubstantiated reductions to the Project's anticipated hauling trips. Using the mitigated

---

[18] "Guidance Manual for preparation of Health Risk Assessments." OEHHA, February 2015, *available at:* https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf p. 8-4

[19] "California Environmental Quality Act Air Quality Guidelines." BAAQMD, May 2017, *available at:* https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, p. 2-5.

[20] "AERSCREEN Released as the EPA Recommended Screening Model," USEPA, April 11, 2011, *available at:* http://www.epa.gov/ttn/scram/guidance/clarification/20110411_AERSCREEN_Release_Memo.pdf

[21] "Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments." OEHHA, February 2015, *available at:* https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

[22] "Health Risk Assessments for Proposed Land Use Projects," CAPCOA, July 2009, *available at:* http://www.capcoa.org/wp-content/uploads/2012/03/CAPCOA_HRA_LU_Guidelines_8-6-09.pdf

annual PM_{10} exhaust estimates from our updated CalEEMod model, we prepared a preliminary HRA of the Project's construction health-related impact to existing residential sensitive receptors. Consistent with recommendations set forth by OEHHA, we assumed exposure begins during the third trimester stage of life. The Project's CalEEMod output files indicate that Channel Excavation construction activities will generate approximately 56 pounds of DPM over the 56-day construction period. The AERSCREEN model relies on a continuous average emission rate to simulate maximum downward concentrations from point, area, and volume emission sources. To account for the variability in equipment usage and truck trips over Project construction, we calculated an average DPM emission rate by the following equation:

$$Emission\ Rate\ \left(\frac{grams}{second}\right) = \frac{56.2\ lbs}{56\ days} \times \frac{453.6\ grams}{lbs} \times \frac{1\ day}{24\ hours} \times \frac{1\ hour}{3{,}600\ seconds} = \mathbf{0.0053\ g/s}$$

Using this equation, we estimated an emission rate of 0.0053 grams per second (g/s). Furthermore, the Project's CalEEMod output files indicate that Perris Valley Storm Drain (both phases) and IDI Rider 2 & 4 construction activities will generate approximately 631 pounds of DPM over the 289-day construction period. Applying the same equation used to estimate the DPM rate associated with Channel Excavation construction activities, we estimated the following emission rate for Perris Valley Storm Drain (both phases) and IDI Rider 2 & 4 construction activities:

$$Emission\ Rate\ \left(\frac{grams}{second}\right) = \frac{630.6\ lbs}{289\ days} \times \frac{453.6\ grams}{lbs} \times \frac{1\ day}{24\ hours} \times \frac{1\ hour}{3{,}600\ seconds} = \mathbf{0.0115\ g/s}$$

Using this equation, we estimated an emission rate of 0.0115 g/s. Furthermore, he Project's CalEEMod output files indicate that Perris Valley Storm Drain (phase 2) and IDI Rider 2 & 4 construction activities will generate approximately 451 pounds of DPM over the 102-day construction period. Applying the same equation used to estimate the DPM rate associated with Channel Excavation construction activities, we estimated the following emission rate for Perris Valley Storm Drain (phase 2) and IDI Rider 2 & 4 construction activities:

$$Emission\ Rate\ \left(\frac{grams}{second}\right) = \frac{450.8\ lbs}{102\ days} \times \frac{453.6\ grams}{lbs} \times \frac{1\ day}{24\ hours} \times \frac{1\ hour}{3{,}600\ seconds} = \mathbf{0.0232\ g/s}$$

Using this equation, we estimated an emission rate of 0.0232 g/s. Finally, the Project's CalEEMod output files indicate that the remainder of Perris Valley Storm Drain (phase 2) construction activities will generate approximately 170 pounds of DPM over the 126-day construction period. Applying the same equation used to estimate the DPM rate associated with Channel Excavation construction activities, we estimated the following emission rate for Perris Valley Storm Drain (phase 2) construction activities:

$$Emission\ Rate\ \left(\frac{grams}{second}\right) = \frac{170\ lbs}{126\ days} \times \frac{453.6\ grams}{lbs} \times \frac{1\ day}{24\ hours} \times \frac{1\ hour}{3{,}600\ seconds} = \mathbf{0.0071\ g/s}$$

Using this equation, we estimated an emission rate of 0.0071 g/s. Construction activities were simulated as a 99.2-acre rectangular area source in AERSCREEN with dimensions of 949 meters by 423 meters. A release height of three meters was selected to represent the height of exhaust stacks on heavy-duty vehicles, and an initial vertical dimension of one and a half meters was used to simulate instantaneous plume dispersion upon release. An urban meteorological setting was selected with model-default inputs for wind speed and direction distribution.

The AERSCREEN model generates maximum reasonable estimates of single-hour DPM concentrations from the Project site. EPA guidance suggests that in screening procedures, the annualized average concentration of an air pollutant be estimated by multiplying the single-hour concentration by 10%.[23] Furthermore, according to the DEIR:

> "The residential location with the greatest potential exposure to Project DPM source emissions is located approximately 110 feet south of the Rider 2 building site and represents an existing non-conforming residence within a light industrial-designated land use" (p. 4.3-44).

Thus, we utilized the single-hour concentrations at 25 meters from the Project site. The single-hour concentration estimated by AERSCREEN for Channel Excavation construction activities is approximately 0.7001 µg/m^3 DPM at approximately 25 meters downwind. Multiplying this single-hour concentration by 10%, we get an annualized average concentration 0.07001 µg/m^3 for Project construction at the MEIR. The single-hour concentration estimated by AERSCREEN for Perris Valley Storm Drain (both phases) and IDI Rider 2 & 4 construction activities is approximately 1.519 µg/m^3 DPM at approximately 25 meters downwind. Multiplying this single-hour concentration by 10%, we get an annualized average concentration 0.1519 µg/m^3 for this phase of Project construction at the MEIR. The single-hour concentration estimated by AERSCREEN for Perris Valley Storm Drain (phase 2) and IDI Rider 2 & 4 construction activities is approximately 3.065 µg/m^3 DPM at approximately 25 meters downwind. Multiplying this single-hour concentration by 10%, we get an annualized average concentration 0.3065 µg/m^3 for this phase of Project construction at the MEIR. Finally, the single-hour concentration estimated by AERSCREEN for Perris Valley Storm Drain (phase 2) construction activities is approximately 0.9382 µg/m^3 DPM at approximately 25 meters downwind. Multiplying this single-hour concentration by 10%, we get an annualized average concentration 0.09382 µg/m^3 for this phase of Project construction at the MEIR.

We calculated the excess cancer risk to the MEIR using applicable HRA methodologies prescribed by OEHHA and the SCAQMD. Consistent with the construction schedules included in the DEIR's CalEEMod models, the annualized average concentration for Channel Excavation construction activities was used for the first 0.15 years of the third trimester of pregnancy (0.25 years); the annualized average concentration for Perris Valley Storm Drain (both phases) and IDI Rider 2 & 4 construction activities was used for the remaining 0.1 years of the third trimester of pregnancy and the first 0.7 years of the infantile stage of life (0 – 2 years); the annualized average concentration for Perris Valley Storm Drain (phase 2) and IDI Rider 2 & 4 construction activities was used for the next 0.28 years of the infantile

[23] "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources Revised." EPA, 1992, *available at*: http://www.epa.gov/ttn/scram/guidance/guide/EPA-454R-92-019_OCR.pdf; *see also* "Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments." OEHHA, February 2015, *available at:* https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf, p. 4-36

stage of life; and the annualized average concentration for Perris Valley Storm Drain (phase 2) construction activities was used for the next 0.35 years of the infantile stage of life.

Consistent with OEHHA, as recommended by SCAQMD, BAAQMD, and SJVAPCD guidance, we used Age Sensitivity Factors ("ASFs") to account for the heightened susceptibility of young children to the carcinogenic toxicity of air pollution.[24, 25, 26, 27] According to this guidance, the quantified cancer risk should be multiplied by a factor of ten during the third trimester of pregnancy and during the first two years of life (infant) as well as multiplied by a factor of three during the child stage of life (2 to 16 years). Furthermore, in accordance with guidance set forth by OEHHA, we used the 95th percentile breathing rates for infants.[28] Finally, we used a Fraction of Time At Home ("FAH") value of 1 for the 3rd trimester and infant receptors. We used a cancer potency factor of 1.1 $(mg/kg\text{-}day)^{-1}$ and an averaging time of 25,550 days. The results of our calculations are shown below.

---

[24] "Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments." OEHHA, February 2015, *available at:* https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf.

[25] "Draft Environmental Impact Report (DEIR) for the Proposed The Exchange (SCH No. 2018071058)." SCAQMD, March 2019, *available at:* http://www.aqmd.gov/docs/default-source/ceqa/comment-letters/2019/march/RVC190115-03.pdf?sfvrsn=8, p. 4.

[26] "California Environmental Quality Act Air Quality Guidelines." BAAQMD, May 2017, *available at:* http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, p. 56; see also "Recommended Methods for Screening and Modeling Local Risks and Hazards." BAAQMD, May 2011, *available at:* http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx, p. 65, 86.

[27] "Update to District's Risk Management Policy to Address OEHHA's Revised Risk Assessment Guidance Document." SJVAPCD, May 2015, *available at:* https://www.valleyair.org/busind/pto/staff-report-5-28-15.pdf, p. 8, 20, 24.

[28] "Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics 'Hot Spots' Information and Assessment Act," June 5, 2015, *available at:* http://www.aqmd.gov/docs/default-source/planning/risk-assessment/ab2588-risk-assessment-guidelines.pdf?sfvrsn=6, p. 19.
"Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments." OEHHA, February 2015, *available at:* https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

The Closest Exposed Individual at an Existing Residential Receptor						
Construction Model	**Duration (years)**	**Concentration (ug/m3)**	**Breathing Rate (L/kg-day)**	**Cancer Risk without ASFs***	**ASF**	**Cancer Risk with ASFs***
Channel Excavation	0.15	0.07001	361	5.8E-08	10	5.8E-07
Perris Valley Storm Drain & IDI Rider 2&4	0.10	0.1519	361	8.0E-08	10	8.0E-07
3rd Trimester Duration	***0.25***			***1.4E-07***	***3rd Trimester Exposure***	***1.4E-06***
Perris Valley Storm Drain & IDI Rider 2&4	0.70	0.1519	1090	1.7E-06	10	1.7E-05
Perris Valley Storm Drain & IDI Rider 2&4	0.28	0.3065	1090	1.4E-06	10	1.4E-05
Perris Valley Storm Drain	0.35	0.09382	1090	5.3E-07	10	5.3E-06
Infant Exposure Duration	***1.32***			***3.7E-06***	***Infant Exposure***	***3.7E-05***
Exposure Duration	**1.57**			**3.8E-06**	**Lifetime Exposure**	**3.8E-05**

* We, along with CARB and SCAQMD, recommend using the more updated and health protective 2015 OEHHA guidance, which includes ASFs.

The excess cancer risk posed to infants and during the third trimester of pregnancy at the closest residential receptor, located approximately 25 meters away, over the course of Project construction, with age sensitivity factors, are approximately 37 and 1.4 in one million, respectively. When summed with the DEIR's operational cancer risk estimate of 7.34 in one million, the excess cancer risk over the course of a residential lifetime (30 years) at the closest residential receptor, is approximately 45.74 in one million (p. 4.2-30).[29] Results without age sensitivity factors are presented in the table above, although we **do not** recommend utilizing these values for health risk analysis, as they are less conservative and health-protective according to the most recent guidance. Regardless, the excess cancer risk posed to infants and during the third trimester of pregnancy at the closest residential receptor, located approximately 25 meters away, over the course of Project construction, *without* age sensitivity factors, are approximately 3.7 and 0.14 in one million, respectively. When summed with the DEIR's operational cancer risk estimate of 7.34 in one million, the excess cancer risk over the course of a residential lifetime (30 years) at the closest residential receptor, *without* age sensitivity factors, is approximately 11.18 in one million (p. 4.2-30).[30] The lifetime cancer risk exceeds the SCAQMD threshold of 10 in one million,[31] thus resulting in a potentially significant impact not previously addressed or

[29] 37 in one million + 1.4 in one million + 7.34 in one million = 45.74 in one million.
[30] 3.7 in one million + 0.14 in one million + 7.34 in one million = 11.18 in one million.
[31] "South Coast AQMD Air Quality Significance Thresholds." SCAQMD, April 2019, *available at:* http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf.

identified by the DEIR. While we *recommend* the use of age sensitivity factors, health risk impacts exceed the SCAQMD threshold *regardless*. According to CEQA Guidelines § 15096(g)(2):

> "When an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment."

As you can see, a proposed Project should not be approved if significant impacts are identified that were not previously identified or addressed with all feasible mitigation. Review of the Project's proposed mitigation measures, however, demonstrates that the DEIR fails identify this impact or implement *all feasible* mitigation to mitigate its significance. Therefore, an updated EIR should be prepared and recirculated for the Project, and mitigation should be implemented where necessary, per CEQA Guidelines.

An agency must include an analysis of health risks that connects the Project's air emissions with the health risk posed by those emissions. Our analysis represents a screening-level HRA, which is known to be conservative and tends to err on the side of health protection. The purpose of the screening-level construction HRA shown above is to demonstrate the link between the proposed Project's emissions and the potential health risk. Our screening-level HRA demonstrates that construction and operation of the Project could result in a potentially significant health risk impact, when correct exposure assumptions and up-to-date, applicable guidance are used. Therefore, since our screening-level construction HRA indicates a potentially significant impact, an updated EIR should include a reasonable effort to connect the Project's air quality emissions and the potential health risks posed to nearby receptors. Thus, an updated EIR should include a quantified air pollution model as well as an updated, quantified, refined health risk assessment which adequately and accurately evaluates health risk impacts associated with both Project construction and operation.

Greenhouse Gas

Failure to Adequately Evaluate Greenhouse Gas Impacts

The DEIR estimates that the Project would generate net annual GHG emissions of 13,440.86 metric tons of CO_2 equivalents per year ("MT CO_2e/year") for One Stage Bridge Construction and 13,452.29 MT CO_2e/year for Two Stage Bridge Construction, which would both exceed the SCAQMD threshold for 2020 of 10,000 MT CO_2e/year (see excerpt below) (p. 4.8-17).

Emission Source	Emissions (MT/yr)			
	CO_2	CH_4	N_2O	Total CO_2E[a]
Project with One Stage Bridge Construction				
Annual construction-related emissions amortized over 30 years	126.20	0.02	0.00	126.59
Area Source	0.08	2.10E-04	0.00	0.08
Energy Source	957.00	0.04	9.18E-03	960.66
Mobile Source	11,355.41	0.19	0.00	11,360.24
On-Site Equipment	254.20	0.08	0.00	256.26
Waste	262.07	15.49	0.00	649.27
Water Usage	70.94	0.52	0.01	87.76
Total CO_2E (All Sources)	**13,440.86**			
Project with Two Stage Bridge Construction				
Annual construction-related emissions amortized over 30 years	137.60	0.02	0.00	138.02
Area Source	0.08	2.10E-04	0.00	0.08
Energy Source	957.00	0.04	9.18E-03	960.66
Mobile Source	11,355.41	0.19	0.00	11,360.24
On-Site Equipment	254.20	0.08	0.00	256.26
Waste	262.07	15.49	0.00	649.27
Water Usage	70.94	0.52	0.01	87.76
Total CO_2E (All Sources)	**13,452.29**			

a. CalEEMod reports the most common GHGs emitted which include CO_2, CH_4, and N_2O. These GHGs are then converted into the CO_2e in CalEEMod based on their corresponding GWP. Further, CO_2e is a term used for describing the difference GHGs in a common unit. CO_2e signifies the amount of CO_2 which would have the equivalent GWP.
Annual construction outputs are provided in Appendices 3.1 and 3.2 (CalEEMod) of the Project's GHG Analysis (Appendix H); Annual operational outputs are provided in Appendix 3.4 (CalEEMod) of the Project's GHG Analysis.
Source: (Urban Crossroads, 2020)

As a result, the DEIR concludes that:

> "Project GHG emissions, which exceed applicable SCAQMD numeric thresholds, would be cumulative considerable and ***significant and unavoidable***" (emphasis added) (p. 4.8-17).

However, the DEIR relies upon the Project's consistency with CARB's 2017 *Scoping Plan* and the City of Perris's Climate Action Plan ("CAP") in order to claim that the Project would result in a less-than-significant GHG impact (p. 4.8-18 - 4.8-23). However, the DEIR's GHG analysis, as well as the subsequent less than significant impact conclusion, is incorrect for four reasons.

(1) The DEIR's quantitative GHG analysis relies upon an incorrect and unsubstantiated air model;
(2) The DEIR fails to implement all feasible mitigation;
(3) The DEIR fails to consider the performance-based standards under CARB's 2017 Scoping Plan; and
(4) The DEIR incorrectly relies on the City's CAP.

1) Incorrect and Unsubstantiated Quantitative GHG Analysis

As discussed above, the DEIR estimates that the Project would generate net annual GHG emissions of 13,440.86 MT CO_2e/year for One Stage Bridge Construction and 13,542.29 MT CO_2e/year for Two Stage Bridge Construction (p. 4.8-17). However, the DEIR's quantitative GHG analysis should not be relied upon, as it relies upon an unsubstantiated air model. As previously discussed, when we reviewed the Project's CalEEMod output files, provided as Attachment 3 to Appendix B, the AQIA, we found that several of the values inputted into the model are not consistent with information disclosed in the DEIR and associated documents. As a result, the model underestimates the Project's GHG emissions, and the DEIR's quantitative GHG analysis should not be relied upon to determine Project significance. As previously stated, an updated EIR should be prepared and recirculated that adequately assesses the potential GHG impacts that construction and operation of the proposed Project may have on the surrounding environment.

2) Incorrect Significant and Unavoidable GHG Impact Determination

As discussed above, the DEIR concludes that the Project would result in significant and unavoidable GHG emissions. However, while we agree that the Project's GHG impact would be significant, the DEIR's assertion that the Project's GHG impact would be unavoidable and cannot be mitigated further is incorrect.

According to CEQA Guidelines § 15096(g)(2):

> "When an EIR has been prepared for a project, the Responsible Agency shall not approve the project as proposed if the agency finds any feasible alternative or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment."

As you can see, an impact can only be labeled as significant and unavoidable after all available, feasible mitigation is considered. Review of the Project's proposed mitigation measures, however, demonstrates that the DEIR fails to implement *all feasible* mitigation. Therefore, the DEIR's conclusion that impacts are significant and unavoidable is unsubstantiated. Additional mitigation measures should be identified and incorporated in an updated EIR for the Project, such as those suggested in the section of this letter titled "Feasible Mitigation Measures Available to Reduce Emissions," in order to reduce the Project's GHG emissions to the maximum extent possible.[32] Until all feasible mitigation incorporated, the Project's GHG emissions should not be considered significant and unavoidable.

3) Failure to Consider Performance-Based Standards Under CARB's 2017 Scoping Plan

As previously discussed, the DEIR relies upon the Project's consistency with CARB's 2017 *Scoping Plan* to determine Project GHG significance. However, this is incorrect, as the DEIR fails to consider performance-based measures proposed by CARB.

i. Passenger & Light Duty VMT Per Capita Benchmarks per SB 375

In reaching the State's long-term GHG emission reduction goals, CARB's 2017 *Scoping Plan* explicitly cites to SB 375 and the VMT reductions anticipated under the implementation of Sustainable Community Strategies.[33] CARB has identified the population and daily VMT from passenger autos and light-duty vehicles at the state and county level for each year between 2010 to 2050 under a "baseline

---

[32] See section titled "Feasible Mitigation Measures Available to Reduce Emissions" below. These measures would effectively reduce the Project's GHG emissions.

[33] CARB (Nov. 2017) 2017 Scoping Plan, p. 25, 98, 101-103, https://ww3.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

scenario" that includes "current projections of VMT included in the existing Regional Transportation Plans/Sustainable Communities Strategies (RTP/SCSs) adopted by the State's 18 Metropolitan Planning Organizations (MPOs) pursuant to SB 375 as of 2015."[34] By dividing the projected daily VMT by the service population, we calculated the daily VMT per capita for each year at the state-level for 2010 (baseline year), 2022 (Project operational year), and 2030 (target years under SB 32) (see table below and Attachment B).

2017 Scoping Plan Daily VMT Per Capita			
	State		
Year	**Population**	**LDV VMT Baseline**	**VMT Per Capita**
2010	37,335,085	836,463,980.50	22.40
2022	41,321,565	916,010,145.57	22.17
2030	43,939,250	957,178,153.20	21.78

According to CAPCOA's *CEQA & Climate Change* report, service population is defined as "the sum of the number of residents and the number of jobs supported by the project."[35] The DEIR estimates that the Project would employ 1,313 people (p. 6-2). As the Project does not include any residential land uses, we estimate a service population of 1,313 people.[36] The below table compares the 2017 *Scoping Plan* daily VMT per capita values against the daily VMT per capita values for the Project based on the DEIR's modeling (see table below and Attachment C).

[34] CARB (Jan. 2019) 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals ("Supporting Calculations for 2017 Scoping Plan-Identified VMT Reductions"), Excel Sheet "Readme", https://ww2.arb.ca.gov/sites/default/files/2019-01/sp_mss_vmt_calculations_jan19_0.xlsx.
[35] CAPCOA (Jan. 2008) CEQA & Climate Change, p. 71-72, http://www.capcoa.org/wp-content/uploads/2012/03/CAPCOA-White-Paper.pdf.
[36] Calculated: 1,313 employees + 0 residents = 1,313 service population.

Daily VMT Per Capita from Passenger & Light-Duty Trucks, Exceedances under 2017 Scoping Plan Performance-Based SB 375 Benchmarks	
Sources	**Project**
	Project's Modeling
Annual VMT from Auto & Light-Duty Vehicles	11,294,509
Daily VMT from Auto & Light-Duty Vehicles	30,944
Service Population	1,313.00
Daily VMT Per Capita	23.57
2017 Scoping Plan Benchmarks, Statewide	
22.40 VMT (2010 Baseline) Exceed?	**Yes**
22.17 VMT (2022 Projected) Exceed?	**Yes**
21.78 VMT (2030 Projected) Exceed?	**Yes**

As shown above, the Project's modeling reveals that the Project *exceeds* the CARB 2017 *Scoping Plan* projections for 2010, 2022, *and* 2030. Because the Project exceeds the CARB 2017 *Scoping Plan* performance-based daily VMT per capita projections, the Project conflicts with the CARB 2017 *Scoping Plan* and SB 375. As such, the DEIR's claim that the proposed Project would not conflict with the CARB 2017 *Scoping Plan* is incorrect and unsubstantiated. An updated EIR should be prepared and recirculated for the proposed Project to provide additional information and analysis to conclude less than significant GHG impacts.

4) *Incorrect Reliance on the City's CAP*

As previously stated, the DEIR relies upon the Project's consistency with the City's CAP in order to claim that the Project would result in a less-than-significant GHG impact (p. 4.8-18 - 4.8-23). However, the City's CAP is outdated and inapplicable to the proposed Project. Specifically, the City's CAP states:

> "This Climate Action Plan (CAP) has been developed to address global climate change through the reduction of harmful greenhouse gas (GHG) emissions at the community level, and as part of California's mandated statewide *GHG emissions reduction goals (AB 32)*" (emphasis added).[37]

As the excerpt above demonstrates, the City's CAP was established to determine compliance with *AB 32*, which only contains reduction goals through 2020. As it is already October 2020 and the Project has yet to be approved, we know that the Project will not be operational by 2020. Furthermore, AEP's *Beyond Newhall and 2020: A Field Guide to New CEQA Greenhouse Gas Thresholds and Climate Action Plan Targets for California*, as referenced by the IS/MND, states:

[37] City of Perris Climate Action Plan (2016), p. 7, https://www.cityofperris.org/Home/ShowDocument?id=12935

> "*Projects with a horizon year (e.g. the year in which the project is fully realized) beyond 2020 should not tier from a GHG reduction plan that may be qualified up to 2020 but is not yet qualified for a post-2020 period*" (emphasis added).[38]

As the above excerpt demonstrates, CAPs only qualified up to 2020 should not be relied upon to determine Project significance. As such, the City's CAP should not be relied upon to determine Project significance. Thus, the DEIR's less-than-significant GHG impact conclusion regarding the City's CAP should not be relied upon.

Feasible Mitigation Measures Available to Reduce Emissions

As discussed above, the Project's air quality, health risk, and GHG emissions may result in potentially significant impacts can be mitigated further. In an effort to reduce the Project's emissions, we identified several mitigation measures that are applicable to the proposed Project.

Feasible mitigation measures can be found in CAPCOA's *Quantifying Greenhouse Gas Mitigation Measures*.[39] Therefore, to reduce the Project's emissions, consideration of the following measures should be made:

CAPCOA's *Quantifying Greenhouse Gas Mitigation Measures*[40]
Measures – Energy
Building Energy Use
BE-1 Exceed Title-24 Building Envelope Energy Efficiency Standards (California Building Standards Code) by X% *Range of Effectiveness:* See document for specific improvement desired.
BE-2 Install Programmable Thermostat Timers *Range of Effectiveness:* Best Management Practice – Influences building energy use for heating and cooling.
BE-3 Obtain Third-party HVAC Commissioning and Verification of Energy Savings (to be grouped with BE-1) *Range of Effectiveness:* Not applicable on its own. This measure enhances the effectiveness of BE-1.
BE-4 Install Energy Efficient Appliances Typical reductions for energy-efficient appliances can be found in the *Energy Star and Other Climate Protection Partnerships* Annual Reports.

[38] "Beyond Newhall and 2020: A Field Guide to New CEQA Greenhouse Gas Thresholds and Climate Action Plan Targets for California." Association of Environmental Professionals (AEP), October 2016, *available at:* https://califaep.org/docs/AEP-2016_Final_White_Paper.pdf, p. 38.

[39] http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

[40] "Quantifying Greenhouse Gas Mitigation Measures." California Air Pollution Control Officers Association (CAPCOA), August 2010, *available at:* http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf, p.

Range of Effectiveness: Residential 2-4% GHG emissions from electricity use. Grocery Stores: 17-22% of GHG emissions from electricity use. See document for other land use types.
BE-5 Install Energy Efficient Boilers *Range of Effectiveness:* 1.2-18.4% of boiler GHG emissions.
Lighting
LE-1 Install Higher Efficacy Public Street and Area Lighting *Range of Effectiveness:* 16-40% of outdoor lighting.
LE-2 Limit Outdoor Lighting Requirements *Range of Effectiveness:* Best Management Practice, but may be quantified.
Alternative Energy Generation
AE-1 Establish Onsite Renewable or Carbon-Neutral Energy Systems – Generic *Range of Effectiveness:* 0-100% of GHG emissions associated with electricity use.
AE-2 Establish Onsite Renewable Energy System – Solar Power *Range of Effectiveness:* 0-100% of GHG emissions associated with electricity use.
AE-3 Establish Onsite Renewable Energy System – Wind Power *Range of Effectiveness:* 0-100% of GHG emissions associated with electricity use.
AE-4 Utilize a Combined Heat and Power System *Range of Effectiveness:* 0-46% of GHG emissions associated with electricity use.
AE-5 Establish Methane Recovery in Landfills *Range of Effectiveness:* 73-77% reduction in GHG emissions from landfills without methane recovery.
AE-6 Establish Methane Recovery in Wastewater Treatment Plants *Range of Effectiveness:* 95-97% reduction in GHG emissions from wastewater treatment plants without recovery.
Measures – Transportation
Land Use/Location
LUT-1 Increase Density *Range of Effectiveness:* 0.8-30% vehicle miles traveled (VMT) reduction and therefore a 0.8-30% reduction in GHG emissions.
LUT-2 Increase Location Efficiency *Range of Effectiveness:* 10% vehicle miles traveled (VMT) reduction and therefore 10-65% reduction in GHG emissions.
LUT-4 Increase Destination Accessibility *Range of Effectiveness:* 6.7-20% vehicle miles traveled (VMT) reduction and therefore 6.7-20% reduction in GHG emissions.
LUT-5 Increase Transit Accessibility *Range of Effectiveness:* 0.5-24.6% VMT reduction and therefore 0.5-24.6% reduction in GHG emissions.
LUT-8 Locate Project near Bike Path/Bike Lane

Range of Effectiveness: Grouped strategy (see LUT-4).
Neighborhood/Site Enhancements
SDT-2 Provide Traffic Calming Measures, such as: • 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 trees • Chicanes/chokers *Range of Effectiveness:* 0.25-1% vehicle miles traveled (VMT) reduction and therefore 0.25-1% reduction in GHG emissions.
SDT-5 Incorporate Bike Lane Street Design (on-site) *Range of Effectiveness:* Grouped strategy (see LUT-9).
SDT-6 Provide Bike Parking in Non-Residential Projects *Range of Effectiveness:* Grouped strategy (see LUT-9).
SDT-8 Provide Electric Vehicle Parking *Range of Effectiveness:* Grouped strategy (see SDT-3).
SDT-9 Dedicate Land for Bike Trails *Range of Effectiveness:* Grouped strategy (see LUT-9).
Parking Policy/Pricing
PDT-1 Limit Parking Supply through: • Elimination (or reduction) of minimum parking requirements • Creation of maximum parking requirements • Provision of shared parking *Range of Effectiveness:* 5-12.5% vehicle miles traveled (VMT) reduction and therefore 5-12.5% reduction in GHG emissions.
PDT-2 Unbundle Parking Costs from Property Cost *Range of Effectiveness:* 2.6-13% vehicle miles traveled (VMT) reduction and therefore 2.6-13% reduction in GHG emissions.
PDT-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.
Commute Trip Reduction Programs
TRT-2 Implement Commute Trip Reduction (CTR) Program – Required Implementation/Monitoring

• Established performance standards (e.g. trip reduction requirements) • Required implementation • Regular monitoring and reporting *Range of Effectiveness:* 4.2-21% commute vehicle miles traveled (VMT) reduction and therefore 4.2-21% reduction in commute trip GHG emissions.
TRT-5 Provide End of Trip Facilities, including: • Showers • Secure bicycle lockers • Changing spaces *Range of Effectiveness:* Grouped strategy (see TRT-1 through TRT-3).
TRT-6 Encourage Telecommuting and Alternative Work Schedules, such as: • Staggered starting times • Flexible schedules • Compressed work weeks *Range of Effectiveness:* 0.07-5.5% commute vehicle miles traveled (VMT) reduction and therefore 0.07-5.5% reduction in commute trip GHG emissions.
TRT-8 Implement Preferential Parking Permit Program *Range of Effectiveness:* Grouped strategy (see TRT-1 through TRT-3).
TRT-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.
TRT-12 Implement Bike-Sharing Programs *Range of Effectiveness:* Grouped strategy (see SDT-5 and LUT-9).
TRT-14 Price Workplace Parking, such as: • 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. *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.
TRT-15 Implement Employee Parking "Cash-Out" *Range of Effectiveness:* 0.06-7.7% commute vehicle miles traveled (VMT) reduction and therefore 0.6-7.7% reduction in commute trip GHG emissions.
Transit System Improvements
TST-1 Transit System Improvements, including: • 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. *Range of Effectiveness:* 0.02-3.2% vehicle miles traveled (VMT) reduction and therefore 0.02-3% reduction in GHG emissions.
TST-2 Implement Transit Access Improvements, such as: • Sidewalk/crosswalk safety enhancements • Bus shelter improvements *Range of Effectiveness:* Grouped strategy (see TST-3 and TST-4)
TST-3 Expand Transit Network *Range of Effectiveness:* 0.1-8.2% vehicle miles traveled (VMT) reduction and therefore 0.1-8.2% reduction in GHG emissions.
TST-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.
TST-5 Provide Bike Parking Near Transit *Range of Effectiveness:* Grouped strategy (see TST-3 and TST-4).
TST-6 Provide Local Shuttles *Range of Effectiveness:* Grouped strategy (see TST-4 and TST-5).
Road Pricing/Management
RPT-1 Implement Area or Cordon Pricing *Range of Effectiveness:* 7.9-22% vehicle miles traveled (VMT) reduction and therefore 7.9-22% reduction in GHG emissions.
RPT-2 Improve Traffic Flow, such as: • 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. *Range of Effectiveness:* 0-45% reduction in GHG emissions.
RTP-3 Required Project Contributions to Transportation Infrastructure Improvement Projects *Range of Effectiveness:* Grouped strategy (see RPT-2 and TST-1 through 7).
RTP-4 Install Park-and-Ride Lots *Range of Effectiveness:* Grouped strategy (see RPT-1, TRT-11, TRT-3, and TST-1 through 6).
Measures – Water
Water Supply

WSW-1 Use Reclaimed Water *Range of Effectiveness:* Up to 40% in Northern California and up to 81% in Southern California.
WSW-2 Use Gray Water *Range of Effectiveness:* Up to 100% of outdoor water GHG emissions if outdoor water use is replaced completely with graywater.
WSW-3 Use Locally Sourced Water Supply *Range of Effectiveness:* 0-60% for Northern and Central California, 11-75% for Southern California.
Water Use
WUW-1 Install Low-Flow Water Fixtures *Range of Effectiveness:* 20% of GHG emissions associated with indoor Residential water use; 17-31% of GHGH emissions associated with Non-Residential indoor water use.
WUW-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.
WUW-6 Plant Native or Drought-Resistant Trees and Vegetation *Range of Effectiveness:* Best Management Practice; may be quantified if substantial evidence is available.
Measures – Area Landscaping
Landscaping Equipment
A-2 Implement Lawnmower Exchange Program *Range of Effectiveness:* Best Management Practice, influences Area GHG emissions from landscape equipment.
Measures – Solid Waste
Solid Waste
SW-1 Institute Recycling and Composting Services *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
SW-2 Recycle Demolished Construction Material *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
Measures – Vegetation
Vegetation
V-1 Urban Tree Planting *Range of Effectiveness:* CO_2 reduction varies by number of trees. VOC emissions may increase.
V-2 Create New Vegetated Open Space *Range of Effectiveness: Varies based on amount and type of land vegetated.*
Measures – Construction
Construction
C-1 Urban Tree Planting *Range of Effectiveness:* CO_2 reduction varies by number of trees. VOC emissions may increase.
C-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.
C-4 Institute a Heavy-Duty Off-Road Vehicle Plan, including: • Construction vehicle inventory tracking system; • Requiring hour meters on equipment; • Document the serial number, horsepower, manufacture age, fuel, etc. of all onsite equipment; and • Daily logging of the operating hours of the equipment. *Range of Effectiveness:* Not applicable on its own. This measure ensures compliance with other mitigation measures.
C-5 Implement a Construction Vehicle Inventory Tracking System *Range of Effectiveness:* Not applicable on its own. This measure ensures compliance with other mitigation measures.
Measures – Miscellaneous
Miscellaneous
Misc-1 Establish a Carbon Sequestration Project, such as: • Geologic sequestration or carbon capture and storage techniques, in which CO_2 from point sources is captured and injected underground; • Terrestrial sequestration in which ecosystems are established or preserved to serve as CO_2 sinks; • Novel techniques involving advanced chemical or biological pathways; or • Technologies yet to be discovered. *Range of Effectiveness:* Varies depending on Project Applicant and projects selected. The GHG emissions reduction is subtracted from the overall baseline project emissions inventory.
Misc-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.
Misc-3 Use Local and Sustainable Building Materials *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
Misc-4 Require best Management Practices in Agriculture and Animal Operations
Misc-5 Require Environmentally Responsible Purchasing, such as: • 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; • Leasing equipment from manufacturers who will recycle the components at their end of life; • Choosing ENERGY STAR appliances and Water Sense-certified water fixtures; • Choosing electronic appliances with built in sleep-mode timers; • Purchasing 'green power' (e.g. electricity generated from renewable or hydropower) from the utility; and • Choosing locally-made and distributed products.

Range of Effectiveness: Varies depending on Project Applicant and strategies selected. Best Management Practice.
Misc-6 Implement an Innovative Strategy for GHG Mitigation *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
Measures – General Plans
General Plans
GP-1 Fund Incentives for Energy Efficiency, such as: • 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; • Investing in renewable energy systems *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
GP-2 Establish a Local Farmer's Market *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
GP-3 Establish Community Gardens *Range of Effectiveness:* Varies depending on Project Applicant and strategies selected. Best Management Practice.
GP-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.
GP-5 Implement Strategies to Reduce Urban Heat-Island Effect, such as: • Planting urban shade trees; • Installing reflective roofs; and • Using light-colored or high-albedo pavements and surfaces. *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.

Furthermore, in an effort to reduce the Project's emissions, we identified several mitigation measures that are applicable to the proposed Project from NEDC's *Diesel Emission Controls in Construction Projects.*[41] Therefore, to reduce the Project's emissions, consideration of the following measures should be made:

[41] "Diesel Emission Controls in Construction Projects." Northeast Diesel Collaborative (NEDC), December 2010, *available at:* https://www.epa.gov/sites/production/files/2015-09/documents/nedc-model-contract-sepcification.pdf.

NEDC's *Diesel Emission Controls in Construction Projects*[42]
Measures – Diesel Emission Control Technology
a. Diesel Generators All diesel generators on site for more than 10 total days must be equipped with emission control technology verified by EPA or CARB to reduce PM emissions by a minimum of 85%.
b. Diesel Nonroad Construction Equipment i. All diesel nonroad construction equipment on site for more than 10 total days must have either (1) engines meeting EPA Tier 4 nonroad emission standards or (2) emission control technology verified by EPA or CARB for use with nonroad engines to reduce PM emissions by a minimum of 85% for engines 50hp and greater and by a minimum of 20% for engines less than 50hp.
c. Upon confirming that the diesel vehicle, construction equipment, or generator has either an engine meeting Tier 4 non road emission standards or emission control technology, as specified above, installed and functioning, the developer will issue a compliance sticker. All diesel vehicles, construction equipment, and generators on site shall display the compliance sticker in a visible, external location as designated by the developer.
d. Emission control technology shall be operated, maintained, and serviced as recommended by the emission control technology manufacturer.
e. All diesel vehicles, construction equipment, and generators on site shall be fueled with ultra-low sulfur diesel fuel (ULSD) or a biodiesel blend[43] approved by the original engine manufacturer with sulfur content of 15 ppm or less.
Measures – Additional Diesel Requirements
a. Construction shall not proceed until the contractor submits a certified list of all diesel vehicles, construction equipment, and generators to be used on site. The list shall include the following: i. Contractor and subcontractor name and address, plus contact person responsible for the vehicles or equipment. ii. Equipment type, equipment manufacturer, equipment serial number, engine manufacturer, engine model year, engine certification (Tier rating), horsepower, engine serial number, and expected fuel usage and hours of operation. iii. For the emission control technology installed: technology type, serial number, make, model, manufacturer, EPA/CARB verification number/level, and installation date and hour-meter reading on installation date.
b. If the contractor subsequently needs to bring on site equipment not on the list, the contractor shall submit written notification within 24 hours that attests the equipment complies with all contract conditions and provide information.

[42] "Diesel Emission Controls in Construction Projects." Northeast Diesel Collaborative (NEDC), December 2010, *available at:* https://www.epa.gov/sites/production/files/2015-09/documents/nedc-model-contract-sepcification.pdf.
[43] Biodiesel blends are only to be used in conjunction with the technologies which have been verified for use with biodiesel blends and are subject to the following requirements: http://www.arb.ca.gov/diesel/verdev/reg/biodieselcompliance.pdf.

c.	All diesel equipment shall comply with all pertinent local, state, and federal regulations relative to exhaust emission controls and safety.
Reporting	
a.	For each onroad diesel vehicle, nonroad construction equipment, or generator, the contractor shall submit to the developer's representative a report prior to bringing said equipment on site that includes: i. Equipment type, equipment manufacturer, equipment serial number, engine manufacturer, engine model year, engine certification (Tier rating), horsepower, and engine serial number. ii. The type of emission control technology installed, serial number, make, model, manufacturer, and EPA/CARB verification number/level. iii. The Certification Statement signed and printed on the contractor's letterhead.
b.	The contractor shall submit to the developer's representative a monthly report that, for each onroad diesel vehicle, nonroad construction equipment, or generator onsite, includes: i. Hour-meter readings on arrival on-site, the first and last day of every month, and on off-site date. ii. Any problems with the equipment or emission controls. iii. Certified copies of fuel deliveries for the time period that identify: 1. Source of supply 2. Quantity of fuel 3. Quality of fuel, including sulfur content (percent by weight)

Finally, in an effort to reduce the Project's emissions, we identified several mitigation measures that are applicable to the proposed Project from the Sacramento Metropolitan Air Quality Management District's ("SMAQMD") *Basic Construction Emission Control Practices (Best Management Practices)* and *Enhanced Exhaust Control Practices*.[44, 45] Therefore, to reduce the Project's emissions, consideration of the following measures should be made:

SMAQMD's *Basic Construction Emission Control Practices*[46]
The following Basic Construction Emissions Control Practices are considered feasible for controlling fugitive dust from a construction site. The practices also serve as best management practices (BMPs), allowing the use of the non-zero particulate matter significance thresholds. Lead agencies should add these emission control practices as Conditions of Approval (COA) or include in a Mitigation Monitoring and Reporting Program (MMRP).

[44] "Basic Construction Emission Control Practices (Best Management Practices)." Sacramento Metropolitan Air Quality Management District (SMAQMD), July 2019, *available at:* https://www.epa.gov/sites/production/files/2015-09/documents/nedc-model-contract-sepcification.pdf.

[45] "Enhanced Exhaust Control Practices." Sacramento Metropolitan Air Quality Management District (SMAQMD)October 2013, *available at:* http://www.airquality.org/LandUseTransportation/Documents/Ch3EnhancedExhaustControlFINAL10-2013.pdf.

[46] "Basic Construction Emission Control Practices (Best Management Practices)." Sacramento Metropolitan Air Quality Management District (SMAQMD), July 2019, *available at:* https://www.epa.gov/sites/production/files/2015-09/documents/nedc-model-contract-sepcification.pdf.

All roadways, driveways, sidewalks, parking lots to be paved should be completed as soon as possible. In addition, building pads should be laid as soon as possible after grading unless seeding or soil binders are used.

Although not required by local or state regulation, many construction companies have equipment inspection and maintenance programs to ensure work and fuel efficiencies

Maintain all construction equipment in proper working condition according to manufacturer's specifications. The equipment must be checked by a certified mechanic and determine to be running in proper condition before it is operated.

SMAQMD's *Enhanced Exhaust Control Practices*[47]

1. The project representative shall submit to the lead agency and District a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 horsepower, that will be used an aggregate of 40 or more hours during any portion of the construction project.
    - The inventory shall include the horsepower rating, engine model year, and projected hours of use for each piece of equipment.
    - The project representative shall provide the anticipated construction timeline including start date, and name and phone number of the project manager and on-site foreman.
    - This information shall be submitted at least 4 business days prior to the use of subject heavy-duty off-road equipment.
    - The District's Equipment List Form can be used to submit this information.
    - The inventory shall be updated and submitted monthly throughout the duration of the project, except that an inventory shall not be required for any 30-day period in which no construction activity occurs.
2. The project representative shall provide a plan for approval by the lead agency and District demonstrating that the heavy-duty off-road vehicles (50 horsepower or more) to be used in the construction project, including owned, leased, and subcontractor vehicles, will achieve a project wide fleet-average 20% NOX reduction and 45% particulate reduction compared to the most recent California Air Resources Board (ARB) fleet average.
    - This plan shall be submitted in conjunction with the equipment inventory.
    - Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and/or other options as they become available.
    - The District's Construction Mitigation Calculator can be used to identify an equipment fleet that achieves this reduction.
3. The project representative shall ensure that emissions from all off-road diesel powered equipment used on the project site do not exceed 40% opacity for more than three minutes in any one hour.
    - Any equipment found to exceed 40 percent opacity (or Ringelmann 2.0) shall be repaired immediately.

---

[47] "Enhanced Exhaust Control Practices." Sacramento Metropolitan Air Quality Management District (SMAQMD)October 2013, *available at:* http://www.airquality.org/LandUseTransportation/Documents/Ch3EnhancedExhaustControlFINAL10-2013.pdf.

• Non-compliant equipment will be documented and a summary provided to the lead agency and District monthly. • A visual survey of all in-operation equipment shall be made at least weekly. • A monthly summary of the visual survey results shall be submitted throughout the duration of the project, except that the monthly summary shall not be required for any 30-day period in which no construction activity occurs. The monthly summary shall include the quantity and type of vehicles surveyed as well as the dates of each survey.
4. The District and/or other officials may conduct periodic site inspections to determine compliance. Nothing in this mitigation shall supersede other District, state or federal rules or regulations.

These measures offer a cost-effective, feasible way to incorporate lower-emitting design features into the proposed Project, which subsequently, reduce emissions released during Project construction and operation. An updated EIR should be prepared to include *all feasible* mitigation measures, as well as include an updated air quality and GHG analysis to ensure that the necessary mitigation measures are implemented to reduce emissions to below thresholds. The EIR should also demonstrate a commitment to the implementation of these measures prior to Project approval, to ensure that the Project's significant emissions are reduced to the maximum extent possible.

SWAPE has received limited discovery regarding this project. Additional information may become available in the future; thus, we retain the right to revise or amend this report when additional information becomes available. Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable environmental consultants practicing in this or similar localities at the time of service. No other warranty, expressed or implied, is made as to the scope of work, work methodologies and protocols, site conditions, analytical testing results, and findings presented. This report reflects efforts which were limited to information that was reasonably accessible at the time of the work, and may contain informational gaps, inconsistencies, or otherwise be incomplete due to the unavailability or uncertainty of information obtained or provided by third parties.

Sincerely,

Matt Hagemann, P.G., C.Hg.

Paul E. Rosenfeld, Ph.D.

Line (L)	Value
1	19,241,072
2	58.70%
3	11,294,509
4	11,294,509
5	30,944
6	1,313.00
7	23.57

GHG CALCULATIONS: DEIR Modeling

	Unit
VMT Per Vehicle Type	
Project Total VMT ("IDI Rider 2 & 4 and PVSD Improvement (Operations - Unmitigated), Annual," CalEEMod Output Table 4.2)	
Passenger and Light-Duty VMT Fleet Mix ("IDI Rider 2 & 4 and PVSD Improvement (Operations - Unmitigated), Annual," CalEEMod Output Table 4.4)	
VMT from Passenger & Light-Duty Vehicles**** [Calc: (L1*L2)]	
Daily VMT Per Capita From Passenger and Light Duty Vehicles	
VMT from Passenger & Light-Duty Vehicles**** (see L3)	
Daily VMT from Passenger & Light-Duty Vehicles [Calc: (L4/365)]	
Service Population [0 residents + 1,313 long-term jobs]	
Daily VMT Per Capita [(Calc: L5/L6)]	

2017 Scoping Plan Daily VMT Per Capita			
	State		
Year	**Population**	**LDV VMT Baseline**	**VMT Per Capita**
2010	37,335,085	836,463,980.50	22.40
2022	41,321,565	916,010,145.57	22.17
2030	43,939,250	957,178,153.20	21.78

Daily VMT Per Capita from Passenger & Light-Duty Trucks, Exceedances under 2017 Scoping Plan Performance-Based SB 375 Benchmarks	
Sources	**Project**
	Project's Modeling
Annual VMT from Auto & Light-Duty Vehicles	11,294,509
Daily VMT from Auto & Light-Duty Vehicles	30,944
Service Population	1,313.00
Daily VMT Per Capita	23.57
2017 Scoping Plan Benchmarks, Statewide	
22.40 VMT (2010 Baseline) Exceed?	**Yes**
22.17 VMT (2022 Projected) Exceed?	**Yes**
21.78 VMT (2030 Projected) Exceed?	**Yes**

```
Start date and time  11/02/20 12:37:49

                                AERSCREEN 16216


Channel Excavation Construction


            Channel Excavation Construction



         -----------------  DATA ENTRY VALIDATION  -----------------
                         METRIC              ENGLISH
 ** AREADATA **  ---------------     ----------------

 Emission Rate:    0.530E-02 g/s         0.421E-01 lb/hr
 Area Height:           3.00 meters           9.84 feet
 Area Source Length:  949.00 meters        3113.52 feet
 Area Source Width:   423.00 meters        1387.80 feet
 Vertical Dimension:    1.50 meters           4.92 feet
 Model Mode:           URBAN
 Population:           79133
 Dist to Ambient Air:           1.0 meters             3. feet


 ** BUILDING DATA **
```

No Building Downwash Parameters

** TERRAIN DATA **

No Terrain Elevations

Source Base Elevation: 0.0 meters   0.0 feet

Probe distance: 5000. meters   16404. feet

No flagpole receptors

No discrete receptors used

** FUMIGATION DATA **

No fumigation requested

** METEOROLOGY DATA **

Min/Max Temperature: 250.0 / 310.0 K   -9.7 / 98.3 Deg F

Minimum Wind Speed: 0.5 m/s

Anemometer Height: 10.000 meters

Dominant Surface Profile: Urban

Dominant Climate Type: Average Moisture

Surface friction velocity (u*): not adjusted

DEBUG OPTION ON

AERSCREEN output file:

2020.11.02_IDIRider_Channel.out

*** AERSCREEN Run is Ready to Begin

No terrain used, AERMAP will not be run

****

SURFACE CHARACTERISTICS & MAKEMET

Obtaining surface characteristics...

Using AERMET seasonal surface characteristics for Urban with Average Moisture

Season	Albedo	Bo	zo
Winter	0.35	1.50	1.000
Spring	0.14	1.00	1.000
Summer	0.16	2.00	1.000
Autumn	0.18	2.00	1.000

Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl

Creating met files aerscreen_02_01.sfc & aerscreen_02_01.pfl

Creating met files aerscreen_03_01.sfc & aerscreen_03_01.pfl

Creating met files aerscreen_04_01.sfc & aerscreen_04_01.pfl

Buildings and/or terrain present or rectangular area source, skipping probe

FLOWSECTOR started 11/02/20 12:38:48

****

Running AERMOD

Processing Winter

Processing surface roughness sector 1

```
*****************************************************
Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
*****************************************************

Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  15


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  20


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  25


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 *******************************************
```

```
  Running AERMOD

 Processing Spring


Processing surface roughness sector  1


*****************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   5


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  10
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  20

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  25
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***
 ********************************************

  Running AERMOD
 Processing Summer

Processing surface roughness sector  1

*****************************************************
Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
******************************************************

Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  10


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


******************************************************

Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  15


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


******************************************************

Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  20


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


******************************************************
```

```
Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  25


    ********   WARNING MESSAGES   ********
               ***  NONE  ***
 ********************************************


  Running AERMOD
 Processing Autumn


Processing surface roughness sector  1


*****************************************************
Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   0


    ********   WARNING MESSAGES   ********
               ***  NONE  ***


*****************************************************
Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   5
```

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector 3

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector 10

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector 4

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector 15

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector 5

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector 20

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

 **************************************************
 Processing wind flow sector   6

  AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  25

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

 FLOWSECTOR   ended 11/02/20 12:39:18

 REFINE       started 11/02/20 12:39:18

  AERMOD Finishes Successfully for REFINE stage 3 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

 REFINE       ended 11/02/20 12:39:20

  ********************************************
  AERSCREEN Finished Successfully
  With no errors or warnings
```

Check log file for details

****

Ending date and time 11/02/20 12:39:22

```
 Concentration     Distance Elevation  Diag  Season/Month   Zo sector       Date
 H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS     HT
REF TA     HT
   0.68682E+00         0.99      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.70007E+00        25.00      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.71374E+00        50.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.72694E+00        75.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.73967E+00       100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75196E+00       125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.76387E+00       150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.77538E+00       175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.78654E+00       200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.79735E+00       225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.80783E+00       250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.81798E+00       275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.82787E+00       300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.83746E+00       325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.84681E+00       350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.85584E+00       375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.86465E+00       400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.87322E+00       425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88152E+00       450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
*  0.88964E+00       475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88450E+00       500.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75590E+00       525.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.65909E+00       550.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60773E+00       575.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.56478E+00       600.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52909E+00       625.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49883E+00       650.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47459E+00       675.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45567E+00       699.99      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.43595E+00       725.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.41989E+00       750.00      0.00   5.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.40547E+00       775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.39292E+00       800.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38102E+00       825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36982E+00       850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35921E+00       875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34920E+00       900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33960E+00       925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33046E+00       950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32181E+00       975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31350E+00      1000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30560E+00      1025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29799E+00      1050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29065E+00      1075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28369E+00      1100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27691E+00      1125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27048E+00      1150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26433E+00      1175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25834E+00      1200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.25258E+00      1225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24708E+00      1250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24168E+00      1275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23652E+00      1300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23160E+00      1325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22685E+00      1350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22219E+00      1375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21772E+00      1400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21338E+00      1425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20923E+00      1450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20514E+00      1475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20119E+00      1500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19740E+00      1525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19375E+00      1550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19024E+00      1575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18680E+00      1600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18344E+00      1625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.18017E+00      1650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17700E+00      1675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17394E+00      1700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17098E+00      1725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16811E+00      1750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16527E+00      1775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16252E+00      1800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15986E+00      1825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15729E+00      1850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15480E+00      1875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15239E+00      1900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15005E+00      1925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14774E+00      1950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14544E+00      1975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14322E+00      2000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14105E+00      2025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13895E+00      2050.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13691E+00      2075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13493E+00      2100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13300E+00      2125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13113E+00      2150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12931E+00      2175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12750E+00      2200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12572E+00      2225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12400E+00      2250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12231E+00      2275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12068E+00      2300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11908E+00      2325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11752E+00      2350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11599E+00      2375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11449E+00      2400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11302E+00      2425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11159E+00      2450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.11020E+00      2475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10882E+00      2500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10746E+00      2525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10613E+00      2550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10483E+00      2575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10356E+00      2600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10232E+00      2625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10110E+00      2650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.99917E-01      2675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.98756E-01      2700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.97620E-01      2725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.96508E-01      2750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.95420E-01      2775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.94355E-01      2800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.93313E-01      2825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.92291E-01      2850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.91291E-01      2875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.90308E-01      2900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.89315E-01      2925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88341E-01      2950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.87386E-01      2975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.86450E-01      3000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.85533E-01      3025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.84633E-01      3050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.83751E-01      3075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.82886E-01      3100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.82037E-01      3125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.81204E-01      3150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.80386E-01      3175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.79584E-01      3200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.78796E-01      3225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.78022E-01      3250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.77262E-01      3275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.76517E-01      3300.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75784E-01      3325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75064E-01      3350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.74356E-01      3375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.73661E-01      3400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.72978E-01      3425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.72306E-01      3450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.71633E-01      3475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.70972E-01      3500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.70322E-01      3525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.69683E-01      3550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.69054E-01      3575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.68436E-01      3600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.67827E-01      3625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.67229E-01      3650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66640E-01      3675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66055E-01      3700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.65478E-01      3725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.64909E-01      3750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.64350E-01      3775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63799E-01      3800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63257E-01      3825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.62722E-01      3850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.62197E-01      3875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61679E-01      3900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61168E-01      3925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60666E-01      3950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60171E-01      3975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.59683E-01      4000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.59202E-01      4025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.58729E-01      4050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.58262E-01      4075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.57802E-01      4100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.57348E-01      4125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.56901E-01      4150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.56460E-01      4175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.56025E-01      4200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.55597E-01      4225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.55168E-01      4250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.54744E-01      4275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.54326E-01      4300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.53913E-01      4325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.53506E-01      4350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.53105E-01      4375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52709E-01      4400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52318E-01      4425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.51932E-01      4450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.51552E-01      4475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.51176E-01      4500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.50806E-01      4525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.50440E-01      4550.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.50079E-01      4575.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49723E-01      4600.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49371E-01      4625.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49023E-01      4650.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.48680E-01      4675.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.48341E-01      4700.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.48007E-01      4725.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47676E-01      4750.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47350E-01      4775.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47028E-01      4800.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.46710E-01      4825.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.46395E-01      4850.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.46082E-01      4875.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45772E-01      4900.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45466E-01      4925.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45163E-01      4950.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.44864E-01      4975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.44568E-01      5000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

Start date and time 11/02/20 12:43:02

AERSCREEN 16216

Perris Valley Storm Drain Construction

Perris Valley Storm Drain Construction

----------------- DATA ENTRY VALIDATION -----------------

	METRIC	ENGLISH
** AREADATA **	---------------	----------------
Emission Rate:	0.710E-02 g/s	0.563E-01 lb/hr
Area Height:	3.00 meters	9.84 feet
Area Source Length:	949.00 meters	3113.52 feet
Area Source Width:	423.00 meters	1387.80 feet
Vertical Dimension:	1.50 meters	4.92 feet
Model Mode:	URBAN	
Population:	79133	
Dist to Ambient Air:	1.0 meters	3. feet

** BUILDING DATA **

No Building Downwash Parameters

** TERRAIN DATA **

No Terrain Elevations

Source Base Elevation: 0.0 meters   0.0 feet

Probe distance: 5000. meters   16404. feet

No flagpole receptors

No discrete receptors used

** FUMIGATION DATA **

No fumigation requested

** METEOROLOGY DATA **

Min/Max Temperature: 250.0 / 310.0 K   -9.7 / 98.3 Deg F

Minimum Wind Speed: 0.5 m/s

Anemometer Height: 10.000 meters

Dominant Surface Profile: Urban

Dominant Climate Type: Average Moisture

Surface friction velocity (u*): not adjusted

DEBUG OPTION ON

AERSCREEN output file:

2020.11.02_IDIRider_PerrisValley.out

*** AERSCREEN Run is Ready to Begin

No terrain used, AERMAP will not be run

****

SURFACE CHARACTERISTICS & MAKEMET

Obtaining surface characteristics...

```
Using AERMET seasonal surface characteristics for Urban with Average Moisture

Season             Albedo     Bo       zo

Winter              0.35     1.50     1.000

Spring              0.14     1.00     1.000

Summer              0.16     2.00     1.000

Autumn              0.18     2.00     1.000


Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl


Creating met files aerscreen_02_01.sfc & aerscreen_02_01.pfl


Creating met files aerscreen_03_01.sfc & aerscreen_03_01.pfl


Creating met files aerscreen_04_01.sfc & aerscreen_04_01.pfl


Buildings and/or terrain present or rectangular area source, skipping probe


FLOWSECTOR   started 11/02/20 12:43:50
 *********************************************


  Running AERMOD
 Processing Winter


Processing surface roughness sector  1
```

```
*****************************************************

Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************

Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************

Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
*****************************************************

Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  15


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  20


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  25


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 ********************************************
```

```
  Running AERMOD

 Processing Spring


Processing surface roughness sector  1


**************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


**************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   5


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


**************************************************

Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  10
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  20

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  25
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***
 ********************************************

  Running AERMOD
 Processing Summer

Processing surface roughness sector  1

*****************************************************
Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
**************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  20

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
```

```
Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  25


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 ********************************************


  Running AERMOD

 Processing Autumn


Processing surface roughness sector  1


*****************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   5
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  20
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

********************************************************
Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  25

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

FLOWSECTOR   ended 11/02/20 12:44:20

REFINE       started 11/02/20 12:44:20

 AERMOD Finishes Successfully for REFINE stage 3 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

REFINE       ended 11/02/20 12:44:22

 **********************************************
 AERSCREEN Finished Successfully
 With no errors or warnings
```

Check log file for details

****

Ending date and time 11/02/20 12:44:24

```
 Concentration     Distance Elevation  Diag  Season/Month   Zo sector       Date
 H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS     HT
REF TA     HT
   0.92045E+00         0.99      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.93820E+00        25.00      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.95652E+00        50.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.97420E+00        75.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.99127E+00       100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10078E+01       125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10237E+01       150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10391E+01       175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10541E+01       200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10686E+01       225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10826E+01       250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10962E+01       275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11095E+01       300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11223E+01       325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11349E+01       350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11470E+01       375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.11588E+01       400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11702E+01       425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11814E+01       450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
*  0.11923E+01       475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11854E+01       500.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10130E+01       525.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88327E+00       550.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.81445E+00       575.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75689E+00       600.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.70906E+00       625.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66851E+00       650.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63603E+00       675.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61067E+00       699.99      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.58424E+00       725.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.56272E+00       750.00      0.00   5.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.54339E+00       775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52658E+00       800.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.51063E+00       825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49562E+00       850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.48139E+00       875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.46798E+00       900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45511E+00       925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.44287E+00       950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.43127E+00       975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.42014E+00      1000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.40955E+00      1025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.39935E+00      1050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38952E+00      1075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38019E+00      1100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37110E+00      1125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36248E+00      1150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35424E+00      1175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34622E+00      1200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.33849E+00      1225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33113E+00      1250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32388E+00      1275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31698E+00      1300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31038E+00      1325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30401E+00      1350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29778E+00      1375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29177E+00      1400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28597E+00      1425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28040E+00      1450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27492E+00      1475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26963E+00      1500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26454E+00      1525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25966E+00      1550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25496E+00      1575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25034E+00      1600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24584E+00      1625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.24145E+00      1650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23720E+00      1675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23310E+00      1700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22914E+00      1725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22529E+00      1750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22148E+00      1775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21780E+00      1800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21424E+00      1825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21079E+00      1850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20745E+00      1875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20422E+00      1900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20109E+00      1925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19799E+00      1950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19492E+00      1975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19193E+00      2000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18903E+00      2025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18622E+00      2050.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18348E+00      2075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18083E+00      2100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17824E+00      2125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17573E+00      2150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17329E+00      2175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17086E+00      2200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16849E+00      2225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16617E+00      2250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16392E+00      2275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16172E+00      2300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15959E+00      2325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15750E+00      2350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15544E+00      2375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15343E+00      2400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15147E+00      2425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14955E+00      2450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.14768E+00      2475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14584E+00      2500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14401E+00      2525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14223E+00      2550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14049E+00      2575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13879E+00      2600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13712E+00      2625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13550E+00      2650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13390E+00      2675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13235E+00      2700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13083E+00      2725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12934E+00      2750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12788E+00      2775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12645E+00      2800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12505E+00      2825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12368E+00      2850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12234E+00      2875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.12103E+00      2900.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11970E+00      2925.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11839E+00      2950.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11711E+00      2975.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11586E+00      3000.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11463E+00      3025.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11342E+00      3050.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11224E+00      3075.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11108E+00      3100.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10994E+00      3125.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10882E+00      3150.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10773E+00      3175.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10665E+00      3200.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10560E+00      3225.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10456E+00      3250.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10354E+00      3275.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10254E+00      3300.00      0.00   0.0        Winter      0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10156E+00      3325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10060E+00      3350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.99649E-01      3375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.98717E-01      3400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.97802E-01      3425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.96901E-01      3450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.95999E-01      3475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.95113E-01      3500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.94242E-01      3525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.93385E-01      3550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.92543E-01      3575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.91714E-01      3600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.90899E-01      3625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.90097E-01      3650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.89308E-01      3675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88524E-01      3700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.87750E-01      3725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.86988E-01      3750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.86238E-01      3775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.85500E-01      3800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.84773E-01      3825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.84058E-01      3850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.83353E-01      3875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.82659E-01      3900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.81975E-01      3925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.81301E-01      3950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.80638E-01      3975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.79984E-01      4000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.79340E-01      4025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.78705E-01      4050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.78080E-01      4075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.77463E-01      4100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.76855E-01      4125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.76256E-01      4150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75665E-01      4175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75083E-01      4200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.74508E-01      4225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.73934E-01      4250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.73366E-01      4275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.72805E-01      4300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.72252E-01      4325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.71707E-01      4350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.71169E-01      4375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.70638E-01      4400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.70114E-01      4425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.69597E-01      4450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.69087E-01      4475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.68584E-01      4500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.68088E-01      4525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.67597E-01      4550.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.67113E-01      4575.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66636E-01      4600.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66164E-01      4625.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.65698E-01      4650.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.65239E-01      4675.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.64785E-01      4700.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.64336E-01      4725.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63894E-01      4750.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63456E-01      4775.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63024E-01      4800.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.62598E-01      4825.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.62176E-01      4850.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61757E-01      4875.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61342E-01      4900.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60931E-01      4925.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60525E-01      4950.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.60124E-01      4975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.59728E-01      5000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
Start date and time  11/02/20 12:41:16

                              AERSCREEN 16216


Perris Valley Storm Drain and IDI Rider 2 & 4 Construction


            Perris Valley Storm Drain and IDI Rider 2 & 4 Construction



         -----------------  DATA ENTRY VALIDATION  -----------------

                        METRIC              ENGLISH

 ** AREADATA **  ---------------     ----------------


 Emission Rate:       0.0232 g/s            0.184 lb/hr

 Area Height:           3.00 meters          9.84 feet

 Area Source Length:  949.00 meters        3113.52 feet

 Area Source Width:   423.00 meters        1387.80 feet

 Vertical Dimension:    1.50 meters          4.92 feet

 Model Mode:           URBAN

 Population:           79133

 Dist to Ambient Air:           1.0 meters             3. feet



 ** BUILDING DATA **
```

No Building Downwash Parameters

** TERRAIN DATA **

No Terrain Elevations

Source Base Elevation: 0.0 meters   0.0 feet

Probe distance: 5000. meters   16404. feet

No flagpole receptors

No discrete receptors used

** FUMIGATION DATA **

No fumigation requested

** METEOROLOGY DATA **

Min/Max Temperature: 250.0 / 310.0 K   -9.7 / 98.3 Deg F

Minimum Wind Speed: 0.5 m/s

Anemometer Height: 10.000 meters

Dominant Surface Profile: Urban

Dominant Climate Type: Average Moisture

Surface friction velocity (u*): not adjusted

DEBUG OPTION ON

AERSCREEN output file:

2020.11.02_IDIRider_PerrisValleyIDIRider.out

*** AERSCREEN Run is Ready to Begin

No terrain used, AERMAP will not be run

****

SURFACE CHARACTERISTICS & MAKEMET

Obtaining surface characteristics...

```
Using AERMET seasonal surface characteristics for Urban with Average Moisture

Season            Albedo     Bo       zo

Winter             0.35     1.50     1.000

Spring             0.14     1.00     1.000

Summer             0.16     2.00     1.000

Autumn             0.18     2.00     1.000


Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl


Creating met files aerscreen_02_01.sfc & aerscreen_02_01.pfl


Creating met files aerscreen_03_01.sfc & aerscreen_03_01.pfl


Creating met files aerscreen_04_01.sfc & aerscreen_04_01.pfl


Buildings and/or terrain present or rectangular area source, skipping probe


FLOWSECTOR   started 11/02/20 12:42:22
 ********************************************


  Running AERMOD

 Processing Winter


Processing surface roughness sector  1
```

```
**************************************************
Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
**************************************************

Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  15


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


**************************************************

Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  20


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


**************************************************

Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  25


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 ******************************************
```

```
  Running AERMOD

 Processing Spring


Processing surface roughness sector  1


*****************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   5


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  10
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  20

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  25
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***
 ********************************************


  Running AERMOD
 Processing Summer


Processing surface roughness sector  1


*****************************************************
Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   0


    ********   WARNING MESSAGES   ********
               ***  NONE  ***


*****************************************************
Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   5


    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
*****************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  20

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
```

```
Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  25


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 ********************************************


  Running AERMOD

 Processing Autumn


Processing surface roughness sector  1


*****************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   5
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  20
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

***************************************************
Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  25

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

FLOWSECTOR   ended 11/02/20 12:42:51

REFINE       started 11/02/20 12:42:51

 AERMOD Finishes Successfully for REFINE stage 3 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

REFINE       ended 11/02/20 12:42:53

 *********************************************
 AERSCREEN Finished Successfully
 With no errors or warnings
```

Check log file for details

****

Ending date and time 11/02/20 12:42:55

```
 Concentration     Distance Elevation  Diag  Season/Month   Zo sector       Date
 H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS     HT
REF TA     HT
   0.30069E+01         0.99      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30649E+01        25.00      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31248E+01        50.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31825E+01        75.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32383E+01       100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32921E+01       125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33443E+01       150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33946E+01       175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34435E+01       200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34908E+01       225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35367E+01       250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35812E+01       275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36244E+01       300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36664E+01       325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37074E+01       350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37469E+01       375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.37854E+01       400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38230E+01       425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38593E+01       450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
*  0.38949E+01       475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38723E+01       500.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33094E+01       525.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28855E+01       550.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26607E+01       575.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24726E+01       600.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23164E+01       625.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21839E+01       650.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20778E+01       675.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19950E+01       699.99      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19086E+01       725.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18383E+01       750.00      0.00   5.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17752E+01       775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17202E+01       800.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16681E+01       825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16191E+01       850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15726E+01       875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15288E+01       900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14868E+01       925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14468E+01       950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14089E+01       975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13725E+01      1000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13379E+01      1025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13046E+01      1050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12725E+01      1075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12420E+01      1100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12123E+01      1125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11842E+01      1150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11572E+01      1175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11310E+01      1200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.11058E+01      1225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10817E+01      1250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10581E+01      1275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10355E+01      1300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10139E+01      1325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.99315E+00      1350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.97277E+00      1375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.95316E+00      1400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.93420E+00      1425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.91601E+00      1450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.89810E+00      1475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88082E+00      1500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.86422E+00      1525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.84826E+00      1550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.83289E+00      1575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.81782E+00      1600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.80310E+00      1625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.78878E+00      1650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.77490E+00      1675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.76151E+00      1700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.74857E+00      1725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.73599E+00      1750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.72355E+00      1775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.71152E+00      1800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.69988E+00      1825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.68862E+00      1850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.67772E+00      1875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66715E+00      1900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.65691E+00      1925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.64681E+00      1950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63676E+00      1975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.62700E+00      2000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61753E+00      2025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60834E+00      2050.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.59941E+00      2075.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.59073E+00      2100.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.58229E+00      2125.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.57408E+00      2150.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.56610E+00      2175.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.55818E+00      2200.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.55042E+00      2225.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.54286E+00      2250.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.53550E+00      2275.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52833E+00      2300.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52134E+00      2325.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.51452E+00      2350.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.50779E+00      2375.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.50122E+00      2400.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49481E+00      2425.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.48856E+00      2450.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.48245E+00      2475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47644E+00      2500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47047E+00      2525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.46464E+00      2550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45895E+00      2575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45339E+00      2600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.44795E+00      2625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.44264E+00      2650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.43744E+00      2675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.43236E+00      2700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.42738E+00      2725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.42252E+00      2750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.41775E+00      2775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.41309E+00      2800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.40852E+00      2825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.40405E+00      2850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.39967E+00      2875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.39537E+00      2900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.39102E+00      2925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38676E+00      2950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38258E+00      2975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37848E+00      3000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37447E+00      3025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37053E+00      3050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36667E+00      3075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36288E+00      3100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35916E+00      3125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35551E+00      3150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35193E+00      3175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34842E+00      3200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34497E+00      3225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34158E+00      3250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33826E+00      3275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33499E+00      3300.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33178E+00      3325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32863E+00      3350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32553E+00      3375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32249E+00      3400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31950E+00      3425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31656E+00      3450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31361E+00      3475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31072E+00      3500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30787E+00      3525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30507E+00      3550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30232E+00      3575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29961E+00      3600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29695E+00      3625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29433E+00      3650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29175E+00      3675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28919E+00      3700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.28666E+00      3725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28418E+00      3750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28172E+00      3775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27931E+00      3800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27694E+00      3825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27460E+00      3850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27230E+00      3875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27003E+00      3900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26780E+00      3925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26560E+00      3950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26343E+00      3975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26129E+00      4000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25919E+00      4025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25712E+00      4050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25507E+00      4075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25306E+00      4100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25107E+00      4125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.24911E+00      4150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24718E+00      4175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24528E+00      4200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24340E+00      4225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24153E+00      4250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23967E+00      4275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23784E+00      4300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23603E+00      4325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23425E+00      4350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23249E+00      4375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.23076E+00      4400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22905E+00      4425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22736E+00      4450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22570E+00      4475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22405E+00      4500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22243E+00      4525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.22083E+00      4550.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21925E+00      4575.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21769E+00      4600.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21615E+00      4625.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21463E+00      4650.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21312E+00      4675.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21164E+00      4700.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.21017E+00      4725.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20873E+00      4750.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20730E+00      4775.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20589E+00      4800.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20449E+00      4825.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20312E+00      4850.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20175E+00      4875.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.20039E+00      4900.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19905E+00      4925.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19772E+00      4950.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.19641E+00      4975.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19512E+00      5000.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

Start date and time 11/02/20 12:39:25

AERSCREEN 16216

Perris Valley Storm Drain and IDI Rider 2 & 4 Construction

Perris Valley Storm Drain and IDI Rider 2 & 4 Construction

----------------- DATA ENTRY VALIDATION -----------------

	METRIC	ENGLISH
** AREADATA **	---------------	----------------
Emission Rate:	0.0115 g/s	0.091 lb/hr
Area Height:	3.00 meters	9.84 feet
Area Source Length:	949.00 meters	3113.52 feet
Area Source Width:	423.00 meters	1387.80 feet
Vertical Dimension:	1.50 meters	4.92 feet
Model Mode:	URBAN	
Population:	79133	
Dist to Ambient Air:	1.0 meters	3. feet

** BUILDING DATA **

No Building Downwash Parameters

** TERRAIN DATA **

No Terrain Elevations

Source Base Elevation: 0.0 meters   0.0 feet

Probe distance: 5000. meters   16404. feet

No flagpole receptors

No discrete receptors used

** FUMIGATION DATA **

No fumigation requested

** METEOROLOGY DATA **

Min/Max Temperature: 250.0 / 310.0 K   -9.7 / 98.3 Deg F

Minimum Wind Speed: 0.5 m/s

Anemometer Height: 10.000 meters

Dominant Surface Profile: Urban

Dominant Climate Type: Average Moisture

Surface friction velocity (u*): not adjusted

DEBUG OPTION ON

AERSCREEN output file:

2020.11.02_IDIRider_PerrisValleyBothIDIRider.out

*** AERSCREEN Run is Ready to Begin

No terrain used, AERMAP will not be run

****

SURFACE CHARACTERISTICS & MAKEMET

Obtaining surface characteristics...

Using AERMET seasonal surface characteristics for Urban with Average Moisture

Season	Albedo	Bo	zo
Winter	0.35	1.50	1.000
Spring	0.14	1.00	1.000
Summer	0.16	2.00	1.000
Autumn	0.18	2.00	1.000

Creating met files aerscreen_01_01.sfc & aerscreen_01_01.pfl

Creating met files aerscreen_02_01.sfc & aerscreen_02_01.pfl

Creating met files aerscreen_03_01.sfc & aerscreen_03_01.pfl

Creating met files aerscreen_04_01.sfc & aerscreen_04_01.pfl

Buildings and/or terrain present or rectangular area source, skipping probe

FLOWSECTOR started 11/02/20 12:40:36

****

Running AERMOD

Processing Winter

Processing surface roughness sector 1

```
*****************************************************
Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   3

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  10

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
*****************************************************

Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  15


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  20


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   6


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Winter sector  25


    ********   WARNING MESSAGES   ********

               ***  NONE  ***

 ********************************************
```

```
  Running AERMOD

 Processing Spring


Processing surface roughness sector  1


**************************************************

Processing wind flow sector   1


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   0


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


**************************************************

Processing wind flow sector   2


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector   5


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


**************************************************

Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  10
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   4

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  15

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   5

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  20

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Spring sector  25
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***
 ********************************************

  Running AERMOD
 Processing Summer

Processing surface roughness sector  1

*****************************************************
Processing wind flow sector   1

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

*****************************************************
Processing wind flow sector   2

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector   5

    ********   WARNING MESSAGES   ********
               ***  NONE  ***
```

```
*****************************************************

Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  10


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  15


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************

Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector  20


    ********   WARNING MESSAGES   ********

               ***  NONE  ***


*****************************************************
```

Processing wind flow sector   6

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Summer sector 25

******** WARNING MESSAGES ********

*** NONE ***

****

Running AERMOD

Processing Autumn

Processing surface roughness sector 1

****

Processing wind flow sector   1

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   0

******** WARNING MESSAGES ********

*** NONE ***

****

Processing wind flow sector   2

AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector   5

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   3


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  10


    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   4


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  15


    ********   WARNING MESSAGES   ********
               ***  NONE  ***

**************************************************
Processing wind flow sector   5


 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  20
```

```
    ********   WARNING MESSAGES   ********
               ***  NONE  ***

********************************************************

Processing wind flow sector   6

 AERMOD Finishes Successfully for FLOWSECTOR stage 2 Autumn sector  25

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

FLOWSECTOR   ended 11/02/20 12:41:06

REFINE       started 11/02/20 12:41:06

 AERMOD Finishes Successfully for REFINE stage 3 Winter sector   0

    ********   WARNING MESSAGES   ********
               ***  NONE  ***

REFINE       ended 11/02/20 12:41:08

 **********************************************

 AERSCREEN Finished Successfully
 With no errors or warnings
```

Check log file for details

****

Ending date and time 11/02/20 12:41:10

```
 Concentration     Distance Elevation  Diag  Season/Month   Zo sector       Date
 H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS     HT
REF TA     HT
   0.14907E+01         0.99      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15195E+01        25.00      0.00  10.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15491E+01        50.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15778E+01        75.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16054E+01       100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16321E+01       125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16580E+01       150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16829E+01       175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17071E+01       200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17306E+01       225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17534E+01       250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17754E+01       275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17968E+01       300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18177E+01       325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18380E+01       350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18576E+01       375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.18767E+01       400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18953E+01       425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19133E+01       450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
*  0.19309E+01       475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19198E+01       500.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16407E+01       525.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14305E+01       550.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13190E+01       575.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12258E+01       600.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11484E+01       625.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10827E+01       650.00      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10301E+01       675.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.98901E+00       699.99      0.00  20.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.94621E+00       725.00      0.00  15.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.91136E+00       750.00      0.00   5.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.88006E+00       775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.85282E+00       800.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.82699E+00       825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.80268E+00       850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.77965E+00       875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.75793E+00       900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.73708E+00       925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.71726E+00       950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.69847E+00       975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.68044E+00      1000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.66329E+00      1025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.64677E+00      1050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.63084E+00      1075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.61575E+00      1100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.60102E+00      1125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.58706E+00      1150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.57371E+00      1175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.56072E+00      1200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.54821E+00      1225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.53628E+00      1250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.52455E+00      1275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.51336E+00      1300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.50267E+00      1325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.49237E+00      1350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.48226E+00      1375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.47254E+00      1400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.46314E+00      1425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.45412E+00      1450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.44524E+00      1475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.43668E+00      1500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.42845E+00      1525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.42053E+00      1550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.41292E+00      1575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.40544E+00      1600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.39815E+00      1625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.39105E+00      1650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.38417E+00      1675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37753E+00      1700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.37111E+00      1725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.36487E+00      1750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35871E+00      1775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.35274E+00      1800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34697E+00      1825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.34139E+00      1850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33599E+00      1875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.33075E+00      1900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32567E+00      1925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.32066E+00      1950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31568E+00      1975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.31084E+00      2000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30615E+00      2025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.30159E+00      2050.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29716E+00      2075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.29286E+00      2100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28868E+00      2125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28461E+00      2150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.28065E+00      2175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27672E+00      2200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.27288E+00      2225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26913E+00      2250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26548E+00      2275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.26192E+00      2300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25846E+00      2325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25508E+00      2350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.25174E+00      2375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24848E+00      2400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24531E+00      2425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.24221E+00      2450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.23918E+00      2475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.23620E+00      2500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.23324E+00      2525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.23035E+00      2550.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.22753E+00      2575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.22477E+00      2600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.22208E+00      2625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.21944E+00      2650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.21687E+00      2675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.21434E+00      2700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.21188E+00      2725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.20947E+00      2750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.20711E+00      2775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.20479E+00      2800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.20253E+00      2825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.20031E+00      2850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
310.0    2.0
   0.19814E+00      2875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35   0.50   10.0
```

```
310.0    2.0
   0.19601E+00      2900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19385E+00      2925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.19174E+00      2950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18967E+00      2975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18764E+00      3000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18564E+00      3025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18369E+00      3050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.18178E+00      3075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17990E+00      3100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17806E+00      3125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17625E+00      3150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17447E+00      3175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17273E+00      3200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.17102E+00      3225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16934E+00      3250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16770E+00      3275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16608E+00      3300.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16448E+00      3325.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16292E+00      3350.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.16139E+00      3375.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15988E+00      3400.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15840E+00      3425.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15694E+00      3450.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15548E+00      3475.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15404E+00      3500.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15263E+00      3525.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.15124E+00      3550.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14988E+00      3575.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14854E+00      3600.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14722E+00      3625.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14592E+00      3650.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14464E+00      3675.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14337E+00      3700.00      0.00   0.0        Winter      0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.14212E+00      3725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.14088E+00      3750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13967E+00      3775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13847E+00      3800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13729E+00      3825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13614E+00      3850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13499E+00      3875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13387E+00      3900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13276E+00      3925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13167E+00      3950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.13060E+00      3975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12954E+00      4000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12850E+00      4025.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12747E+00      4050.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12645E+00      4075.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12546E+00      4100.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12447E+00      4125.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
```

```
310.0    2.0
   0.12350E+00      4150.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12254E+00      4175.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12160E+00      4200.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.12067E+00      4225.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11974E+00      4250.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11882E+00      4275.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11791E+00      4300.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11702E+00      4325.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11613E+00      4350.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11526E+00      4375.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11440E+00      4400.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11355E+00      4425.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11272E+00      4450.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11189E+00      4475.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11108E+00      4500.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.11027E+00      4525.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10948E+00      4550.00      0.00   0.0        Winter       0-360   10011001
```

```
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10869E+00      4575.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10792E+00      4600.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10716E+00      4625.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10640E+00      4650.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10566E+00      4675.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10492E+00      4700.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10420E+00      4725.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10348E+00      4750.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10277E+00      4775.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10207E+00      4800.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10138E+00      4825.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10070E+00      4850.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.10002E+00      4875.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.99346E-01      4900.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.98681E-01      4925.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.98024E-01      4950.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.       6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

```
   0.97374E-01      4975.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
   0.96733E-01      5000.00      0.00   0.0        Winter       0-360   10011001
-1.30  0.043 -9.000  0.020 -999.   21.      6.0 1.000   1.50   0.35    0.50   10.0
310.0    2.0
```

BLUM | COLLINS LLP

Aon Center
707 Wilshire Boulevard
Suite 4880
Los Angeles, California
90017

213.572-0405 phone
213.572-0401 fax

June 16, 2021

Cathy Perring
City of Perris Planning Division
135 North "D" Street
Perris, CA 92570
cperring@cityofperris.org

Via email

Re: Comments on IDI Rider 2 &4 High Cube Warehouses and PVSD Channel Improvement Project FEIR (SCH No. 2019100297)

Dear Ms. Perring and Honorable City of Perris Planning Commission Members:

Thank you for the opportunity to comment on the Final Environmental Impact Report ("FEIR") for the proposed IDI Rider Warehouses 2 and 4 Project ("the Project"). Please accept and consider these comments on behalf of Golden State Environmental Justice Alliance ("GSEJA"). This letter follows on our letter of last year regarding the Draft EIR ("DEIR"); any responses hereto should be directed to me, bentley@blumcollins.com, and Craig Collins at colllins@blumcollins.com. We have separated our comments on the FEIR into those relating to our comments and those relating to SWAPE's comments.

RESPONSES TO GSEJA'S NOV. 16, 2020 COMMENT LETTER

The section references below are to the DEIR rather than to the FEIR.

1.0 Summary

The Project involves the construction and operation of two warehouse buildings totaling 1,352,736 square feet on a 65 net acre site, improvements to a portion of the PVSD Channel, and replacement of the Rider Street bridge over the PVSD Channel. The DEIR says in total that the Project spans 99.2 acres, with 4.5 acres being offsite. The proposed Rider 2 building is 804,759 sf and the proposed Rider 4 building is 547,977 sf. The Project would involve two Tentative Parcel Maps for the merging of several parcels to form the Rider 2 and 4 sites. According to the DEIR, construction is anticipated to last either 14 months with one-stage bridge construction or 19 months with two-stage bridge construction; we commented on the two-stage alternative as it had more impacts.

1.1 Project Piecemealing

In our original comments, we stated that the EIR did not accurately or adequately describe the full project, meaning "the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment." CEQA Guidelines, § 15378. The Project as described in the DEIR for the Rider 2 and Rider 4 buildings is a piecemealed portion of a larger overall project to be developed within the larger Rider Logistics Center in the City of Perris, containing a minimum of 4 warehouse buildings. The development and operation of the entire Rider Logistics Center should have been considered together, particularly given that the greenhouse gas ("GHG") impacts of the Rider 1 and Rider 3 buildings were almost certainly never evaluated, and that a Health Risk Assessment should have been conducted for the operation of the entire Rider Logistics Center facility.

The Perris Valley Commerce Center Specific Plan Program EIR from 2011 does not even remotely solve these problems, as that EIR covers a vast swath of the City, it did not evaluate GHG impacts either, and it contained no HRA specific to the Rider Logistics Center.

4.2 Agricultural Resources

In our DEIR comments, we asserted that the Project would have significant impacts on agricultural resources – specifically, Farmland of Statewide Importance. In the FEIR, the City's consultants conceded that it is pursuant to this EIR that this Farmland is being converted, so that the General Plan's 1991 change in the use designation for the land is not relevant. Nevertheless, the consultants assert that agricultural impacts are less than significant based on the Department of Conservation's Land Evaluation and Site Assessment ("LESA") Model. The DEIR is somewhat opaque as to how the LESA Model was applied, but it is apparent that the Project was deemed not to have a significant impact as the result of the Land Evaluation component of the Model. It appears that the inclusion of the storm drain channel improvements – which are a public project largely unrelated to the development of the Rider Logistics Center or Rider 2 or 4 – may be the cause for the Land Evaluation component falling below the required factor score of 20. The LESA Model should have been applied without considering this land.

4.3 Air Quality

The City states that it agrees that the present CEQA review is not sufficient to permit cold storage or the presence or use of transport refrigeration units ("TRUs") on the site. The City states that it is including a condition of approval to this effect, and that the prohibition will be included on a restrictive covenant recorded against the property. We appreciate this important concession.

Under *Air Quality Management Plan*, the DEIR stated that the California Air Resources Board ("CARB") released a SIP Update to the AQMP, the 2019 South Coast 8-Hour Ozone SIP Update, which was intended to achieve "the remaining NO_x emissions reductions needed to achieve ***the*** ozone standard in 2023." DEIR at 4.3-15 (emphasis supplied). We commented that this statement seriously understated the severity of ozone problems in the Basin. To be clear, there is more than one ozone standard, and the 2019 South Coast 8-Hour Ozone SIP Update addresses compliance with the ***1997 8-Hour Ozone Standard of 0.08 ppm***, which is out of date, as Attachment A to our DEIR comments made clear. The present NAAQS is 0.070 ppm, and, as we stated in our original comments, the Basin is not projected to achieve compliance with this NAAQS until 2038. Further, the cited SIP Update is not expected to achieve compliance with the 1997 NAAQS until after 2023 anyway, as that Attachment A also makes clear. As we also stated in our DEIR comments, in addition to the fact that the Basin is in Extreme Nonattainment with three ozone NAAQS, it is also in Serious Nonattainment with respect to the 2012 Annual $PM_{2.5}$ NAAQS.

The FEIR states in Response to Comment F-10 that "improvements to regional air quality are discussed in detail in Section 2.9 of the Project's Air Quality Impact Analysis," and that supposedly the DEIR's failure to reference the true severity of the region's air quality problems is of no moment. This is inaccurate. While the Air Quality Impact Analysis shows a table reflecting that exceedances of the 2015 8-Hour NAAQS for ozone have declined slightly ***Basin-wide***, it is also apparent that the maximum federal 8-hour concentration in parts per million has increased in the Project area (Source Receptor Area 24) since 2016, as have the number of days the federal 8-Hour Standard has been exceeded, as well as the number of days the State 1-Hour Standard has been exceeded. *See* DEIR Table 4.3-2. Since the average reader is not likely to discern the true state of affairs from the ***text*** of the DEIR (or the FEIR), the EIR fails as an informational document.

We asserted that the Project did not demonstrate consistency with the applicable Air Quality Management Plan. In response, the City's consultants assert that the City's Localized Significance Threshold ("LST") analysis shows that the Project would not "increase the frequency or severity of an existing ambient air quality violation." We disagree, because the consultants did their LST analysis by assessing the impacts of only 5% of the Project's emissions.

As we noted in our original comments, under Threshold b., the DEIR acknowledges a significant impact both as to construction and operations with respect to regional emissions of NO_x. With respect to construction, the City now proposes new Mitigation Measure ("MM") 3-15 which it says requires the use of Tier 4 construction equipment "to the extent feasible." The MM itself requires the use of Tier 4 Final equipment ***unless*** it is not available within a 50-mile radius, or it is "uneconomical to use." Tier 4 Final equipment will ***always*** cost more to acquire, and the MM provides no standards by which the City is to determine whether the equipment is "uneconomical," so the MM might as well not be there.

As we made clear in our original comments, a lead agency must adopt ***all*** feasible mitigation with respect to any significant impact. *City of Marina v. Bd. of Trustees of Cal. State Univ.* ("*City of Marina*") (2006) 39 Cal. 4th 341, 349, *citing* Pub. Res. Code §§ 21002.1(a), (b), 21100(b)(3), and Guidelines § 15126.4(a)(1) ("CEQA requires '[e]ach public agency [to] mitigate or avoid the significant effects on the environment of projects it carries out or approves whenever it is feasible to do so' and to discuss feasible methods of mitigation in the EIR"). This would apply to Tier 4 Final equipment for construction, and measures such as EV charging for trucks and cars with respect to operations. While your consultants contend that we provided "no substantial evidence that the installation of charging stations or electrical conduits will mitigate the Project's air pollutant and GHG emissions levels to insignificance," we disagree that that is the standard, and we think it is obvious that with enough of the proposed mitigation, Project emissions ***would*** be reduced to less than significant levels. The City's consultants cite to a couple of Court of Appeal opinions in support of the proposition that, supposedly, we have to show that a proposed MM would reduce impacts to a less than significant level, but the Supreme Court's precedent trumps any Court of Appeal language on this point. *Auto Equity Sales, Inc. v. Superior Court* (1962) 57 Cal. 2d 450, 455.

Regarding Response to Comment F-14, again, most readers cannot be expected to review tables in the DEIR for consistencies with the text. The statement in the text was highly misleading, and the DEIR should be recirculated.

In our DEIR comments, we stated that:

> The City ***has*** included an MM to indicate that electrical supply lines and panels shall be sized to support heavy truck charging when electric trucks become available (they are available ***now***, *see* Attachment C), but it states that "Electrical system upgrades that exceed reasonable costs shall not be required," which is entirely standardless and makes the measure totally toothless.

November 16, 2020 comments at 5. In Response to Comment F-15, which was this one, the City's consultants now argue that "CEQA only requires mitigation measures which are feasible," and that "At present, requiring zero-emission (electric) trucks is economically and technologically infeasible." This argument completely sidesteps the point that we made, which is (again) that the MM the City purported to impose – MM 3-14 – will not ***be*** imposed. The consultants apparently attempt to justify this result by citing to a September 2017 report by the International Council on Clean Transportation ("ICCT"). Things have changed a lot in the past few years on this front, as is made apparent by Attachment C to our original comment letter, which is an August 2019 report by the same entity. *See* Attachment C to our DEIR comment letter, at page i, discussing Table ES-1 ("even if fleets were to bear . . . associated infrastructures costs, the overall vehicle ownership cost of electric trucks [of Classes 6, 7 and 8] wil generally be lower than conventional vehicle costs by 2030"). Thus, actually requiring electric trucks, ***not*** just the electrical supply lines and panels to support them, would be feasible, and ***both*** should be actually required.

We said that the DEIR lacked a quantitative Health Risk Assessment for construction, and the City's consultants prepared a ***screening-level*** HRA in response. From everything we can tell, that screening-level HRA should have been followed up with a full HRA, as the FEIR discloses that the maximum risk would be 6.32 in a million, and this figure must be ***added*** to the 7.34 risk in a million arrived at by the operational HRA, assuming that the maximally exposed individual receptor is the same. In other words, the maximum risk from construction and operation of the Project is 13.66 in a million, which exceeds 10 in a million, which is the SCAQMD threshold for significance. Further, we do not agree that the assumptions in the screening-level construction HRA are adequately health-protective, as construction sites often have more than one shift of workers, so assuming that equipment would only operate for eight hours a day was unwarranted.

We commented that the DEIR did not include relevant environmental justice issues in reviewing potential impacts. We weren't the only ones to do so. In Response to Comment F-18, the City claims that "environmental justice impacts that are not associated with physical environmental impacts" need not be assessed. However, nowhere in the EIR, including in the DEIR's Cumulative Impacts discussion, does the City address the overall pollution burden of the community including from the Project and other sources. The Response states that "Information about CalEnviroScreen is discussed in the Draft EIR under "Disadvantaged Communities" in the Air Quality section. We do not see it in the cited location. The Response further asserts that the DEIR's reference to the Community Air Protection Program suffices, and that CARB did not identify any community in the vicinity of the Project pursuant to that Program, but obviously, this does not mean that the Project's public health impacts are insignificant.

4.4 Biological Resources

In our DEIR comments, we stated that the applicant should have done protocol surveys for the Stephens' kangaroo rat ("SKR"). Response to Comment F-20 claims that "SKR are not expected to occur in the Project area due to a lack of suitable habitat in the ruderal uplands" on the Project site. There is nothing to prevent SKR from subsisting in ruderal habitat. The DEIR acknowledges that the species can tolerate routine disturbances such as the tilling and discing that occur on the site. Indeed, SKR have been known to subsist in roadsides.

We commented that the County of Riverside's Ordinance No. 633 as amended indicates that the payment of mitigation fees with respect to SKR habitat is only appropriate if it is determined through the environmental review process that onsite mitigation is unwarranted. The City did not respond. Without protocol-level surveys there is no basis for concluding that the site is not occupied. It isn't a moot point.

We commented that the Project failed to adequately assess impacts to the burrowing owl or to adequately mitigate such impacts. Response to Comment F-21 claims that "The commenter provides no substantial evidence supporting the assertion that the Project's burrowing owl mitigation is inadequate or that the development of the Project will generate significant burrowing owl impacts." This is false, we provided substantial evidence of both, because the DEIR and the Mitigation Monitoring and Reporting Program only require a buffer of 250 ***feet*** around active nests, whereas the 2012 Burrowing Owl CDFW Staff Report calls for a buffer of 500 ***meters***. As we indicated previously, the Staff Report is applicable under the MSHCP Guidelines.

4.6 Energy

In our DEIR comments, we noted that the Project did not demonstrate the wise or efficient use of energy, citing two cases: *Ukiah Citizens for Safety First v. City of Ukiah* (2016) 248 Cal. App. 4th 256, 265, and *California Clean Energy Comm. v. City of Woodland* (2014) 223 Cal. App. 4th 173, 211. The City claimed in the FEIR that the Project complies with CEQA Guidelines Appendix F because it will have "solar-ready" roofs where possible. Again, this is not sufficient, as this is ***required*** under the 2019 provisions of Title 24, Part 6 – as the City subsequently acknowledges itself in Response to Comment F-26. *See* https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center/solar. The Project applicant will need to fill out form NRCC-SRA-E.

The City contends in the FEIR that our comments do not "identify any ways in which the Project would result in a potentially significant environmental impact due to wasteful, inefficient or unnecessary consumption of energy." Again, we pointed you to two cases in which mere Code compliance was not enough, and the City has not identified anything ***beyond*** Code compliance with respect to energy efficiency which would distinguish the present situation from the two cases cited.

In what the City identified as Comment F-23, we indicated that the DEIR's reference to a "single-event demand" for construction fuel use was misleading because gasoline is a non-renewable resource. Obviously, we meant to cover diesel fuel use as well.

The FEIR contends that our comments were "incorrect[]" that the "Project does not discuss plans for the installation of solar or renewable energy," because "solar is discussed within the context of applicable Title 24 requirements" supposedly at page 4.3-12, and that Section 4.6 of the DEIR "discusses solar power generation that is being provided by Southern California Edison." We see no reference to solar on page 4.3-12, and anyway, the point we were making is that ***the Project*** provides no solar or other renewable energy, which is one of the things Appendix F to the CEQA guidelines calls for.

In our DEIR comments, we indicated that the City needs to impose mitigation including the installation of solar panels pursuant to the City's Climate Action Plan ("CAP"), because the City said there that it expected 20% of new commercial energy use to come from renewable sources. To be more specific, the Perris CAP anticipates a 1,843 $MTCO_2e$ reduction from commercial developers providing "On-site solar photovoltaic," "On-site thermal water heating," or "support for off-site solar or wind generation," and states that this assumption was based on "an average of 5kW of solar photovoltaic cells [being] installed per 10,000 square feet of building space." Perris CAP at 3-39, 3-40. Since the Project involves the development of 1,352,736 square feet of development, and it requires no commitments relating to solar or other renewable energy from the applicant, and it is apparently the only CEQA project of any sort the City is considering at this time, we think it is entirely reasonable to ask where Perris is on its goal of installing solar on 20 percent of commercial development's power coming from on-site or off-site solar being provided by commercial developers, and that this question is highly relevant to the City's compliance with CEQA Guidelines, Appendix F. The FEIR's bare statement in Response to Comment F-26 that the comment provides "no substantial evidence that the Project's energy impacts are significant" lacks support, and, further, the EIR fails as an informational document with respect to energy compliance.

Since we are on the topic of the City's CAP, we also want to point out that the City anticipated 22,688 $MTCO_2e$ in reductions by 2020 from goods movement improvements through the "greater penetration of low-emission trucks in the region," including "electrification and other low-emission technologies installed" in trucks, *see* Perris CAP at 3-12, and the Project does nothing to further this goal, and in fact will hinder it to the extent that electric trucks will not be supported. The CAP also anticipates 81,152 $MTCO_2e$ in reductions by 2020 from "strategies to encourage the purchase and use of electric vehicles," including the installation of electric vehicle charging. Perris CAP at 3-13. Again, the Project is not doing its share of furthering this goal, and we'd like to know where the City stands on achieving it.

4.8 Greenhouse Gases (GHGs)

We pointed out that the DEIR cited to the 2017 CARB Scoping Plan Update's call for "contributions from all sectors of the economy, including the land base," including "enhanced focus on zero- and near-zero emission (ZE/NZE) vehicle technologies," and "continued investment in renewables, including solar roofs, wind, and other distributed generation," as well as "integrated land conservation and development strategies," and "coordinated efforts to reduce emission so short-lived climate pollutants" such as "black carbon," which is a primary constituent of DPM. We noted that the City isn't assisting with any of the identified strategies with respect to this Project. In Response to Comment F-30, the City's consultants say that supposedly "The point here is to provide background," and reiterate that "The City has no specific control as previously discussed with respect to tailpipe emissions." This is of course not true for all the reasons identified in this letter and our original comment letter. The City could have the applicant install solar, EV charging, and electric truck charging for this Project. It has ***chosen*** not to do so.

Still in the introductory section, the DEIR refers to the City of Perris CAP and states that the CAP has a 2035 reduction target. Whether it has this target or not, there was and is no substantial evidence that the City has planned for or demonstrated reductions into 2035, and the CAP acknowledged that it needed updating in 2017, which never happened. The Perris Climate Action Plan is available at https://www.cityofperris.org/Home/ShowDocument?id=12935. We presume the City will include it in the Administrative Record since the DEIR relies upon it, as well as all the other documents we provided specific hyperlinks to, under established case law.

In Response to Comment F-31, the City asserts that the City of Perris CAP "is summarized in the Draft EIR as a matter of background and for informational purposes," and that supposedly the DEIR relies primarily on the numerical threshold and the "overall statewide plan to reduce GHG emissions." Despite what the FEIR states here, it is clear that the City analyzes with the City of Perris Climate Action Plan and the 2017 Scoping Plan Update under Threshold b.

We commented on the internal inconsistency of the CAP, because it was used as a threshold in this EIR, and the City's consultants responded that our comments did not have to do with the EIR. We have to disagree.

The 2017 Scoping Plan Update calls for the conservation of natural and working lands and we pointed out that the Project has the opposite effect. The City ignores this point and argues that the Perris Valley Commerce Center Specific Plan turns them into "building sites." Again, impacts are to be determined when the Project is implemented, and this Project takes away agricultural land of Statewide Importance.

4.11 Land Use and Planning

In what the City designated as our Comment F-37, we said that the DEIR's conclusion that the Project was consistent with Goal 6 of the 2016-2040 RTP/SCS was incorrect based on the Project's significant and unavoidable GHG and Air Quality impacts. The Response to this Comment claims that the 2016-2040 RTC/SCS is not meant to address GHGs or improve air quality. This is false. As the drafters of the FEIR well know, the very purpose of an RTP/SCS is to address GHGs from regional transportation, as the Legislature intended when it adopted SB 375. The Response to Comment goes on to aver that an "alleged inconsistency" is not an "environmental impact." With all due respect, the City's consultants' wordplay is not enough to avoid the fact that a straightforward analysis of consistency with applicable plans and policies is a requirement for an EIR, and the DEIR and FEIR are not up to snuff in this regard.

The FEIR engages in significant discussion of how – supposedly – NO_2 levels are expected to be reduced "approximately 68% by 2023 and 80% by 2031 from 2012 levels to meet established ambient air quality standards," and that "As a result, NO_2 levels are forecast to be substantially lower in the future," because somehow SCAQMD is to achieve these goals. Of course, the FEIR engages in ***no*** discussion of ***how*** SCAQMD is going to achieve these goals in the face of Projects like the present one, and we question whether it can. We note that SCAQMD has adopted an Indirect Source Rule which will apply to the Project and which neither the DEIR nor the FEIR acknowledge.

RESPONSES TO SWAPE'S NOV. 5, 2020 LETTER

In Response to Comment F-46, the consultants attempt to dispense with SWAPE's comment that the consultants had not adequately analyzed scraper emissions in CalEEMod 2016.3.2. SWAPE's comment was that the trip length by the scrapers would not equal 0, and that the scraper trips (of which there would be a substantial number) were not analyzed.

Like us, SWAPE recommended the implementation of an MM requiring the use of Tier 4 Final construction equipment. We dealt with the City's refusal to implement such an MM above.

SWAPE commented that the Project lacked a quantitative HRA for construction activities. The City's consultants level several claims against SWAPE's screening level HRA for construction, but the results of their own screening-level construction HRA prove the point SWAPE was making nonetheless: the Project will have significant impacts after the construction and operational risks are summed, as they should be.

CONCLUSION

GSEJA continues to believe the EIR is flawed and an amended EIR must be prepared for the proposed project and recirculated for public review. Please advise us by email of any developments on this Project. Thank you.

Sincerely,

Hannah Bentley

Hannah Bentley
BLUM | COLLINS LLP