

**APPENDIX 4.5**

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**Greenhouse Gas Emissions**

## Road Construction Emissions Model, Version 6.3.2

Emission Estimates for -> Via Princessa East Extension										
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	8.4	37.3	72.5	13.1	3.1	10.0	4.9	2.8	2.1	8,150.6
Grading/Excavation	8.3	36.4	70.1	13.0	3.0	10.0	4.8	2.7	2.1	8,179.6
Drainage/Utilities/Sub-Grade	3.0	13.5	22.5	11.1	1.1	10.0	3.1	1.0	2.1	3,022.3
Paving	1.9	8.7	11.4	1.0	1.0	-	0.9	0.9	-	1,327.3
<b>Maximum (pounds/day)</b>	<b>8.4</b>	<b>37.3</b>	<b>72.5</b>	<b>13.1</b>	<b>3.1</b>	<b>10.0</b>	<b>4.9</b>	<b>2.8</b>	<b>2.1</b>	<b>8,179.6</b>
<b>Total (tons/construction project)</b>	<b>2.4</b>	<b>10.7</b>	<b>19.9</b>	<b>4.5</b>	<b>0.9</b>	<b>3.6</b>	<b>1.6</b>	<b>0.8</b>	<b>0.7</b>	<b>2,365.7</b>

Notes: Project Start Year -> 2013  
 Project Length (months) -> 38  
 Total Project Area (acres) -> 25  
 Maximum Area Disturbed/Day (acres) -> 1  
 Total Soil Imported/Exported (yd<sup>3</sup>/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Emission Estimates for -> Via Princessa East Extension										
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	3.8	16.9	33.0	5.9	1.4	4.5	2.2	1.3	0.9	3,704.8
Grading/Excavation	3.8	16.6	31.9	5.9	1.4	4.5	2.2	1.2	0.9	3,718.0
Drainage/Utilities/Sub-Grade	1.3	6.1	10.2	5.1	0.5	4.5	1.4	0.5	0.9	1,373.8
Paving	0.9	4.0	5.2	0.4	0.4	-	0.4	0.4	-	603.3
<b>Maximum (kilograms/day)</b>	<b>3.8</b>	<b>16.9</b>	<b>33.0</b>	<b>5.9</b>	<b>1.4</b>	<b>4.5</b>	<b>2.2</b>	<b>1.3</b>	<b>0.9</b>	<b>3,718.0</b>
<b>Total (megagrams/construction project)</b>	<b>2.2</b>	<b>9.7</b>	<b>18.0</b>	<b>4.0</b>	<b>0.8</b>	<b>3.2</b>	<b>1.4</b>	<b>0.7</b>	<b>0.7</b>	<b>2,145.7</b>

Notes: Project Start Year -> 2013  
 Project Length (months) -> 38  
 Total Project Area (hectares) -> 10  
 Maximum Area Disturbed/Day (hectares) -> 0  
 Total Soil Imported/Exported (meters<sup>3</sup>/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Air Quality\112.28 Via Princessa\Emissions\Onsite CutFill Emissions.urb924

Project Name: Via Princessa - onsite cut and fill

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	<u>CO2</u>
2013 TOTALS (lbs/day unmitigated)	2,371.65
2013 TOTALS (lbs/day mitigated)	2,371.65
2014 TOTALS (lbs/day unmitigated)	2,371.64
2014 TOTALS (lbs/day mitigated)	2,371.64
2015 TOTALS (lbs/day unmitigated)	2,371.63
2015 TOTALS (lbs/day mitigated)	2,371.63

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Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

	<u>CO2</u>
Time Slice 9/2/2013-12/31/2013	<u>2,371.65</u>
Active Days: 87	
Mass Grading 09/01/2013-01/31/2015	2,371.65
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,247.32
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	124.33
Time Slice 1/1/2014-12/31/2014	<u>2,371.64</u>
Active Days: 261	
Mass Grading 09/01/2013-01/31/2015	2,371.64
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,247.32
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	124.32
Time Slice 1/1/2015-1/30/2015 Active Days: 22	<u>2,371.63</u>
Mass Grading 09/01/2013-01/31/2015	2,371.63
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,247.32
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	124.31

Phase Assumptions

Phase: Mass Grading 9/1/2013 - 1/31/2015 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 25.2

Maximum Daily Acreage Disturbed: 1

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 2025.84 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Mitigated

	<u>CO2</u>
Time Slice 9/2/2013-12/31/2013	<u>2,371.65</u>
Active Days: 87	
Mass Grading 09/01/2013-01/31/2015	2,371.65
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,247.32
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	124.33
Time Slice 1/1/2014-12/31/2014	<u>2,371.64</u>
Active Days: 261	
Mass Grading 09/01/2013-01/31/2015	2,371.64
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,247.32
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	124.32

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Time Slice 1/1/2015-1/30/2015 Active	<u>2,371.63</u>
Days: 22	
Mass Grading 09/01/2013-01/31/2015	2,371.63
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,247.32
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	124.31

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 9/1/2013 - 1/31/2015 - Default Mass Site Grading/Excavation Description

For Soil Stabilizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Soil Stabilizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Manage haul road dust 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

**Via Princessa East Extension Project  
Evaluation of Greenhouse Gas Emissions**

**Street Lighting and Traffic Signal Electrical Demand Greenhouse Gas Emissions**

Project	Wattage Per Light/Signal Bulb <sup>1,2</sup> (kW)	Number of Light/Signal Posts <sup>3,4</sup>	Number of Bulbs Per Light/Signal Post <sup>5</sup>	Operating Hours Per Year <sup>6</sup> (hr/yr)	Annual Demand Factor (MW-hr/yr)	CO <sub>2</sub> Emission Factor <sup>7</sup> GWP = 1 (lbs/MW-hr)	CH <sub>4</sub> Emission Factor <sup>8</sup> GWP = 21 (lbs/MW-hr)	N <sub>2</sub> O Emission Factor <sup>8</sup> GWP = 310 (lbs/MW-hr)	Annual CO <sub>2</sub> e Emissions (MTCO <sub>2</sub> e/yr)
Proposed Project									
Street Lights	0.250	98	1	4,100	100.45	630.89	0.029	0.011	28.93
Traffic Signals	0.109	12	3	8,760	34.37	630.89	0.029	0.011	9.90
Subtotal									38.83

Sources:

- Street Lights: Green Energy LLC/PTL Solar FZ LLC, "Operating Data and the Economics of Different Lamps," <http://www.solarstreetlights.net/generalinfo.html>. 2011. Assumes high pressure sodium lights at 250 watts (mid-range estimate) per bulb (see footnote 12 on website).
- Traffic Signal: U.S. Department of Energy, *State Energy Program: Case Studies*, n.d. Report can be downloaded from the following website: <http://www.nrel.gov/docs/fy04osti/35551.pdf>. Assumes 109 watts (mid-range estimate) per incandescent bulb.
- Street Lights: Assumes 1 street light post every 130 feet (consistent with existing street lights on Via Princessa) on both sides.
- Traffic Signal: Assumes 4 signals at the intersection of Rainbow Glen and Via Princessa, with 3 individual signal placards at each of the 4 directions.
- Assumes 1 bulb per street light and 3 bulbs per traffic signal placard.
- Assumes 4,100 hours for street lighting (estimated annual dusk to dawn hours) and year-round operation of traffic signal.
- California Climate Action Registry, "Climate Action Registry Reporting Online Tool," <https://www.climateregistry.org/CARROT/public/reports.aspx>. 2011. See *2007 Annual Entity Emissions: Electric Power Generation/Electric Utility Sector, Southern California Edison*.
- The Climate Registry, Local Government Operations Protocol, Version 1.1, (2010) 208, 209. The report can be downloaded from the following website: <http://www.theclimateregistry.org/resources/protocols/local-government-operations-protocol/>.

Where:

CH <sub>4</sub>	Methane	lbs	Pounds
CO <sub>2</sub>	Carbon dioxide	MW	Megawatt
CO <sub>2</sub> e	Carbon dioxide equivalent	MT	Metric ton
GWP	Global warming potential	N <sub>2</sub> O	Nitrous oxide
hr	Hour	yr	Year
kW	Kilowatt		

Combined Annual Emissions Reports (Tons/Year)

File Name: Z:\Air Quality\112.28 Via Princessa\Emissions\Operational Truck Emissions.urb924

Project Name: Via Princessa Operational Maintenance Trips

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	<u>CO2</u>
TOTALS (tons/year, unmitigated)	7.91

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	<u>CO2</u>
TOTALS (tons/year, unmitigated)	7.91

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

<u>Source</u>	<u>CO2</u>
Blank (Edit this description)	7.91
TOTALS (tons/year, unmitigated)	7.91



Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2016 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Blank (Edit this description)		1.14	1000 sq ft	1.00	1.14	10.23
					1.14	10.23

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	0.0	0.2	99.6	0.2
Light Truck < 3750 lbs	0.0	0.0	98.6	1.4
Light Truck 3751-5750 lbs	0.0	0.0	100.0	0.0
Med Truck 5751-8500 lbs	0.0	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.0	0.0	82.4	17.6
Lite-Heavy Truck 10,001-14,000 lbs	0.0	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.0	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	100.0	0.0	0.0	100.0
Other Bus	0.0	0.0	0.0	100.0
Urban Bus	0.0	0.0	0.0	100.0
Motorcycle	0.0	48.3	51.7	0.0
School Bus	0.0	0.0	0.0	100.0
Motor Home	0.0	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	12.7	7.0	9.5	13.3	7.4	8.9
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Blank (Edit this description)				2.0	1.0	97.0