Appendix G
Energy Calculations

ESA

LCWA Restoration Program EIR
Construction Energy Analysis

Fuel Consumption Summary

Category	Value
Diesel fuel for heavy-duty construction equipment	2,977,544
Diesel fuel for Haul Trucks	65,909
Diesel fuel for Vendor Trucks	4,762
Gasoline fuel for workers	127,191
Total Diesel Consumption from Equipment and Trucks	3,048,215
Total Gasoline Consumption	127,191
Construction Phase Duration (years)	22.0
Annual Average Gallons Diesel From Equipment and Trucks	138,555
Annual Average Gallons Diesel From Boats	100,594
Annual Average Gallons Diesel	**239,149**
Annual Average Gallons Gasoline	**5,781**

Source	Diesel	Gas
Off-Road Equipment	2,977,544	-
Haul/Vendor	70,671	-
Tug Boats	2,213,058	-
Worker	-	127,191
Total Project Fuel Consumption	**5,261,273**	**127,191**
Annual Average Gallons Diesel	**239,149**	
Annual Average Gallons Gasoline		**5,781**

	Los Angeles County Fuel Consumption		State Fuel Consumption	
	Diesel	**Gas**	**Diesel**	**Gas**
	590,196,078	3,659,000,000	3,798,039,216	15,584,000,000
Annual Project % of Consumption	0.041%	0.0002%	0.0063%	0.0000%

	Orange County Fuel Consumption	
	Diesel	**Gas**
	119,607,843	1,382,000,000
Annual Project % of Consumption	0.200%	0.0004%

1. California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results, 2017
   https://www.energy.ca.gov/almanac/transportation_data/gasoline/2010-2017_A15_Results.xlsx
   Diesel is adjusted to account for retail (51%) and non-retail (49%) diesel sales.

2. SCE, 2017 Financial and Statistical Report

   https://www.edison.com/content/dam/eix/documents/investors/sec-filings-financials/2017-financial-statistical-report.pdf. Accessed January 2019.

LCWA Restoration Program EIR
Construction Energy Analysis

Off-Road Equipment

Equipment ≤ 100 HP

Parameter	Value
pounds diesel fuel/hp-hr (lb/hp-hr):[1]	0.41
diesel fuel density (lb/gal):[1]	7.11
diesel gallons/hp-hr (gal/hp-hr):	0.06
Total hp-hr :	9,635,047
Total diesel consumption (gal):	552,983

Equipment > 100 HP

Parameter	Value
pounds diesel fuel/hp-hr (lb/hp-hr):[1]	0.37
diesel fuel density (lb/gal):[1]	7.11
diesel gallons/hp-hr (gal/hp-hr):	0.05
Total hp-hr:	46,964,471
Total diesel gallons:	2,424,561

Total diesel gallons (off-road equipment): 2,977,544

1. 2017 Off-road Diesel Emission Factors, cells B30 and B31

Phase	Equipment	# of Equipment	Hours/ Day	HP	Load Factor	Days	Total hp-hr
Demolition and Site Preparation	Concrete saws	1	8	81	0.73	1560	737,942
Demolition and Site Preparation	Excavators	3	8	158	0.38	1560	2,247,898
Demolition and Site Preparation	Rubber Tired Dozers	2	8	247	0.40	1560	2,466,048
Demolition and Site Preparation	Tractors/Loaders/Backhoes	2	8	97	0.37	1560	892,183
Grading/Excavation - option 1	Excavators	2	8	158	0.38	5720	5,494,861
Grading/Excavation - option 1	Graders	1	8	187	0.41	5720	3,508,419
Grading/Excavation - option 1	Rubber Tired Dozers	1	8	247	0.40	5720	4,521,088
Grading/Excavation - option 1	Scrapers	2	8	367	0.48	5720	16,122,163
Grading/Excavation - option 1	Tractors/Loaders/Backhoes	2	8	97	0.37	5720	3,284,653
Grading/Excavation - option 1	Other Construction Equipment	2	8	172	0.42	5720	6,538,994
Grading/Excavation - option 1	Cranes	1	7	231	0.29	5720	2,664,706
Drainage/Utilities/Subgrade	Excavators	2	8	158	0.38	1560	1,498,598
Drainage/Utilities/Subgrade	Trenchers	2	2	78	0.50	1560	244,577
Drainage/Utilities/Subgrade	Pumps	2	8	84	0.74	1560	1,551,514
Drainage/Utilities/Subgrade	Bore/drill rig	1	6	221	0.50	1560	1,039,451
Building Construction	Cranes	1	7	231	0.29	1560	731,531
Building Construction	Forklifts	3	8	89	0.20	1560	666,432
Building Construction	Generator Sets	1	8	84	0.74	1560	775,757
Building Construction	Tractors/Loaders/Backhoes	3	7	97	0.37	1560	1,175,756
Building Construction	Welders	1	8	46	0.45	1560	258,336
Paving	Pavers	2	8	130	0.42	80	69,888
Paving	Paving Equipment	2	8	132	0.36	80	60,826
Paving	Rollers	2	8	80	0.38	80	38,912
Architectural Coating	Air Compressors	1	6	78	0.48	40	8,986

Total ≤ 100	9,635,047
Total >100	46,964,471

LCWA Restoration Program EIR
Construction Energy Analysis

On-Road Haul Trucks (HHDT)

Parameter	Value
EMFAC2017 Diesel Fuel Consumption Factor (gal/mile):[1]	0.16
Total Haul Truck VMT (miles):	419,958
Total VMT diesel gallons (on-road haul trucks):	**65,173**
HHDT Idling Fuel Consumption Factor (gal/min):[2]	0.015
Total Haul Truck Idle-Minutes per Year (minutes):	136,350
Total Idling diesel gallons (on-road haul trucks)[3]:	**736**
Total diesel gallons (on-road haul trucks):	**65,909**

Without ATCM	Gallons Saved
2045	1309

1. California Air Resources Board, EMFAC2017 (Los Angeles County; Annual; CY 2020; Aggregate MY; Aggregate Speed, HHDT, DSL)
2. 1. Idle Fuel Consumption for Selected Gasoline and Diesel Vehicles, US Department of Energy. Accessed February 2019. https://www.energy.gov/eere/vehicles/fact-861-february-23-2015-idle-fuel-consumption-selected-gasoline-and-diesel-vehicles
3. Incorporates estimated fuel savings from Anit-Idling Regulation (64 percent based on estimated CARB emissions reductions)
   Source: California Air Resources Board (CARB), 2004. Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling, Appendix F, July 2004, https://www.arb.ca.gov/regact/idling/isorappf.pdf.

Phase	Total One-Way Trips	Miles/Trip	VMT	Idle Minutes
Demolition and site prep	4,680	23	108,108	35,100
Grading/Excavation -option 1	13,500	23	311,850	101,250
Drainage/Utilities/Subgrade				
Building Construction				
Paving				
Architectural Coating				

Total Haul Truck VMT: 419,958

Total Idle Minutes: 136,350

LCWA Restoration Program EIR
Construction Energy Analysis

On-Road Vendor Trucks (HHDT/MHDT)

Parameter	Value
EMFAC2017 Diesel Fuel Consumption Factor (gal/mile):[1]	0.1269
Total Haul Truck VMT (miles):	35,880
Total VMT diesel gallons (on-road vendor trucks):	**4,552**
HHDT Idling Fuel Consumption Factor (gal/min):[2]	0.0150
Total Vendor Truck Idle-minutes (min):	39,000
Total Idling diesel gallons (on-road vendor trucks):	**211**
Total diesel gallons (on-road vendor trucks):	**4,762**

1. California Air Resources Board, EMFAC2017 (Los Angeles County; Annual; CY 2020; Aggregate MY; Aggregate Speed, HHDT/MHDT, DSL)
2. 1. Idle Fuel Consumption for Selected Gasoline and Diesel Vehicles, US Department of Energy. Accessed February 2019. https://www.energy.gov/eere/vehicles/fact-861-february-23-2015-idle-fuel-consumption-selected-gasoline-and-diesel-vehicles
3. Source: California Air Resources Board (CARB), 2004. Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling, Appendix F, July 2004, https://www.arb.ca.gov/regact/idling/idling.htm, accessed November 2016.

Phase	Days	Trips/Day	Miles/Trip	VMT	Idle Minutes
Demolition and site prep					
Grading/Excavation -option 1					
Drainage/Utilities/Subgrade					
Building Construction	260	20	6.9	35,880	39,000
Paving					
Architectural Coating					

Total Vendor Truck VMT: 35,880

Total Idle-Minutes 39,000

LCWA Restoration Program EIR
Construction Energy Analysis

On-Road Workers (LDA, LDT1, LDT2)

Parameter	Value
EMFAC2017 Gasoline Fuel Consumption Factor (gal/mile):[1]	0.038
Total Worker VMT (miles):	3,362,184
Total VMT gasoline gallons (workers):	**127,191**

1. California Air Resources Board, EMFAC2017 (Los Angeles County; LDA, LDT1, LDT2; CY 2020; Aggregate MY; Aggregate Speed,GAS)

Phase	Days	One-Way Trips/Day	Miles/Trip	VMT
Demolition and site prep	1560	20	14.7	458,640
Grading/Excavation -option 1	5720	28	14.7	2,354,352
Drainage/Utilities/Subgrade	1560	18	14.7	412,776
Building Construction	260	30	14.7	114,660
Paving	80	15	14.7	17,640
Architectural Coating	40	7	14.7	4,116
			Worker VMT	3,362,184

LCWA Restoration Program EIR
Boat Fuel Consumption

	Existing	ng/Excavation	ing/Excavation Year 2
Unmitigated CO_2e (MT/year)	0	1022.03	
Mitigated CO_2e (MT/year)	0		

Summary	Existing		Op year 1		Op year 2		
	Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated	
Gasolilne	0	0	0	0	0	0	gallons
Diesel	0	0	100,594	0.00	0	0	gallons
Electric	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	GWh
Natural Gas	0.00	0.00	212.36	0.00	0.00	0.00	MBTU

Existing 2020

Unmitigated Calculations

	% Emissions	CO_2e (MT)	CO_2e (kg)	CO_2e (lbs)	kg CO2/gallon	Gallons	Mcf	MBTU	GWh
Gasoline	0.830175983	0	0	NA	8.89	0	NA	NA	NA
Diesel	0.159170192	0	0	NA	10.16	0	NA	NA	NA
Electric	0	0	NA	0	NA	NA	NA	NA	#DIV/0!
Natural Gas	0.010653825	0	0	NA	NA	NA	0.00	0.00	NA

Mitigated Calculations

	% Emissions	CO_2e (MT)	CO_2e (kg)	CO_2e (lbs)	kg CO2/gallon	Gallons	Mcf	MBTU	GWh
Gasoline	0.830175983	0	0	NA	8.89	0	NA	NA	NA
Diesel	0.159170192	0	0	NA	10.16	0	NA	NA	NA
Electric	0	0	NA	0	NA	NA	NA	NA	#DIV/0!
Natural Gas	0.010653825	0	0	NA	NA	NA	0.00	0.00	NA

Grading/Excavation Year 1 2020

Unmitigated Calculations

	% Emissions	CO_2e (MT)	CO_2e (kg)	CO_2e (lbs)	kg CO2/gallon	Gallons	Mcf	MBTU	GWh
Gasoline	0	0	0	NA	8.89	0	NA	NA	NA
Diesel	1	1022.030435	1,022,030	NA	10.16	100,594	NA	NA	NA
Electric	0	0	NA	0	NA	NA	NA	NA	#DIV/0!
Natural Gas	0.010653825	10.88853335	10,889	NA	NA	NA	204.98	212.36	NA

Mitigated Calculations

	% Emissions	CO_2e (MT)	CO_2e (kg)	CO_2e (lbs)	kg CO2/gallon	Gallons	Mcf	MBTU	GWh
Gasoline	0	0	0	NA	8.89	0	NA	NA	NA
Diesel	1	0	0	NA	10.16	0	NA	NA	NA
Electric	0	0	NA	0	NA	NA	NA	NA	#DIV/0!
Natural Gas	0.010653825	0	0	NA	NA	NA	0.00	0.00	NA

Grading/Excavation Year 2 | 2022

Unmitigated Calculations

	% Emissions	CO_2e (MT)	CO_2e (kg)	CO_2e (lbs)	kg CO2/gallon	Gallons	Mcf	MBTU	GWh
Gasoline	0.820835292	0	0	NA	8.89	0	NA	NA	NA
Diesel	0.16753441	0	0	NA	10.16	0	NA	NA	NA
Electric	0	0	NA	0	NA	NA	NA	NA	#DIV/0!
Natural Gas	0.011630299	0	0	NA	NA	NA	0.00	0.00	NA

Mitigated Calculations

	% Emissions	CO_2e (MT)	CO_2e (kg)	CO_2e (lbs)	kg CO2/gallon	Gallons	Mcf	MBTU	GWh
Gasoline	0.820835292	0	0	NA	8.89	0	NA	NA	NA
Diesel	0.16753441	0	0	NA	10.16	0	NA	NA	NA
Electric	0	0	NA	0	NA	NA	NA	NA	#DIV/0!
Natural Gas	0.011630299	0	0	NA	NA	NA	0.00	0.00	NA

Emissions Percentage

	2020	2021	2022	2023
Gasoline	0.830175983	0.825152152	0.820835292	0.81972918
Diesel	0.159170192	0.163720699	0.16753441	0.168098815
Electric	0	0	0	0
Natural Gas	0.010653825	0.011127148	0.011630299	0.012172004

Conversion Factors:

1000	kg/MT	
8.89	kg CO_2/gallon gasoline	https://www.eia.gov/environment/emissions/co2_vol_mass.php
10.16	kg CO_2/gallon diesel	https://www.eia.gov/environment/emissions/co2_vol_mass.php
53.12	kg CO_2/ thousand cubic feet	https://www.eia.gov/environment/emissions/co2_vol_mass.php
1036	btu/cubic foot	
0.907185	MT/ton	
2000	lbs/ton	

LCWA Restoration Program EIR
Electricty and Natural Gas Consumption

Electricity	kWh/yr	GWh/yr
General Office Building	25,980	0.026
City Park	0	-
Total	**25,980**	**0.026**
Total (including water, see below)	**31,952**	**0.032**
Net Project Energy Consumption	**31,952**	**0.032**

Electricity	GWh/yr
SCE 2017 Electricity Sales[1]	85,879
Project Annual	0.032
Net Project Annual	0.032
Percent Net Project of SCE	0.00004%

Water	Mgal/yr
General Office Building	0.459
City Park	-
Total	**0.459**

Electricity Intensity Factors[4]	kWh/Mgal
Electricity Factor - Supply	9,727
Electricity Factor - Treat	111
Electricity Factor - Distribute	1,272
Electricity Factor - Wastewater Treatment	1,911

Electricity from Water Demand	kWh/yr	GWh/yr
Total	**5,972**	**0.006**

Source: California Air Resources Board, CalEEMod, Version 2016.3.2.
Base water demand is based on rates provided in City of Los Angeles Department of Public Works, Sewage Facilities Charge, Sewage Generation Factor for Residential and Commercial Categories, 2012.

Natural Gas	kBtu/yr	cubic foot (cf)[3]	Per day Usage
General Office Building	20,820	20,077	
City Park	0	-	
Project Total	**20,820**	**20,077**	55
Project Net Total	**20,820**	**20,077**	**55**

Natural Gas	million cubic foot (cf)
SoCalGas 2017 Sales[2]	913,960
Project Annual	0.020
Net Project Annual	0.020
Percent Net Project of SoCalGas	0.000002%

1. Southern California Edison, 2017 Financial and Statistical Report, p.3
   2017 Financial and Statistical Report
2. California Gas and Electric Utilities, 2018 California Gas Report, p. 101, 2018.
   https://www.socalgas.com/regulatory/documents/cgr/2018_California_Gas_Report.pdf
3. Conversion factor of 1,037 Btu per cubic foot based on United States Energy Information Administration data
   https://www.eia.gov/tools/faqs/faq.php?id=45&t=8
4. California Air Resources Board, CalEEMod, Version 2016.3.2.

LCWA Restoration Program EIR
Operational Energy Analysis

Project Fuel Usage

Annual VMT (All): 1,240,402 miles/year (from CalEEMod)

Fuel Type:[1]	**GAS**	**DSL**
Percent:	98%	7%
Miles per Gallon Fuel:	25.97	10.19
Annual VMT by Fuel Type (miles):	1,219,706	86,786
Project Annual Fuel Usage (gallons):	**46,964**	**8,514**

	Los Angeles County Fuel Consumption [2]		**State Fuel Consumption** [2]	
	Gasoline	Diesel	Gasoline	Diesel
	3,659,000,000	590,196,078	15,584,000,000	3,798,039,216
Project Annual:	46,964	8,514	46,964	8,514
Percent Project of Los Angeles County:	0.001%	0.001%	0.000%	0.000%

	Orange County Fuel Consumption [2]	
	Gasoline	Diesel
	1,382,000,000	119,607,843
Project Annual:	46,964	8,514
Percent Project of Los Angeles County:	0.003%	0.007%

Notes:

1. California Air Resources Board, EMFAC2014 (Los Angeles County; Annual; 2022, Aggregate Fleet).
2. California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results, 2017.
   Available at: http://www.energy.ca.gov/almanac/transportation_data/gasoline/piira_retail_survey.html.
   Accessed March 2019. Diesel is adjusted to account for retail (51%) and non-retail (49%) diesel sales

Region	SOUTH COAST AQMD
Model Year	Aggregated
Speed	(All)

Row Labels	Sum of VMT	Sum of Fuel Consumption
DSL	32970821.18	3234.708375
ELEC	6527260.047	0
GAS	431741633.7	16623.79283
NG	798459.2845	242.0339944
Grand Total	**472038174.2**	**20100.5352**

Fuel Factors (All Vehicle Categories)

Fuel Type	VMT (mi/day)	Fuel Consumption (1000gal/day)	Fuel Consumption Factor (gal/mi)	Fleet Distribution	Fuel Economy (mi/gal)
DSL	32970821.18	3234.71	0.098	7%	10.19
ELEC	6527260.047	0.00	0.000	1.5%	
GAS	431741633.7	16623.79	0.039	98.3%	25.97
NG	798459.2845	242.03	0.303	0.2%	3.30

EMFAC2017 Webdatabase