APPENDIX D: AVON MARINE TERMINAL EMISSIONS CALCULATIONS METHODOLOGY

AVON MARINE TERMINAL EMISSIONS CALCULATION BACKGROUND

Emissions of criteria pollutants and greenhouse gases (GHG) were calculated for the continued operations and construction associated with the Avon Marine Oil Terminal Lease Consideration Project (Project).

Construction Emissions Estimation Methodology:

Criteria pollutant and GHG emissions from heavy-duty equipment, on-road vehicle trips, and land disturbance were estimated using the California Emissions Estimator Model (CalEEMod) (Version 2013.2.2). CalEEMod is a statewide land use emissions computer model designed to provide a uniform platform to quantify potential criteria air pollutants and GHGs associated with construction and operations projects. The model was developed by ENVIRON in collaboration with the air districts of California.

Vehicle and equipment data was provided by Tesoro. For each construction phase this data included;

- Construction phase duration (start and end dates)
- In-use Heavy equipment types
- Equipment horsepower
- Equipment daily operating hours
- Number of workdays per week
- Average number of construction staff
- Average number of equipment/supply deliveries

A summary of the CalEEMod input data that was provided by Tesoro is located in Table A-3 of Attachment A. Equipment load factors were based on CalEEMod default data. CalEEMod estimates tons per year of criteria pollutants and metric tons per year of greenhouse gases. This model output data was used to calculate the daily average criteria pollutant emissions by dividing the annual quantity by the construction project duration and converting to pounds.

The CalEEMod model does not include marine-based emissions sources; therefore, emissions associated with work boats used for construction were calculated independently of CalEEMod and added to the predicted totals. The construction workboat criteria and GHG emissions were estimated using methodology from the CARB emissions estimation guidance documents titled *Assumptions for Estimating Greenhouse Gas Emissions from Commercial Harbor Craft Operating in California* (CARB 2008) and *Emissions Estimation Methodology for Commercial Harbor Craft Operating in California* (CARB 2007). The methodology was developed by CARB to calculate an updated inventory of commercial harbor craft emissions to support regulatory analysis. Due to a lack of CH_4 and N_2O emission factors in the CARB methodology, these emission factors were resourced from the Port of Long Beach Air Emissions Inventory from 2011 (Starcrest Consulting Group, LLC 2012).

The construction emissions calculation spreadsheets are provided as Attachment A and the CalEEMod modeling output data is provided as Attachment B.

Operational Emissions Estimation Methodology:

Emissions from operational OGV activity were estimated using calculation methodology prescribed in the CARB Technical Support Division guidance document titled "Emissions Estimation Methodology for Ocean-Going Vessels" (CARB 2011). Emissions from operational tugboat activity were estimated using calculation methodology prescribed in the CARB guidance document titled "Emissions Estimation Methodology for Commercial Harbor Craft Operating in California (CARB 2007). Tables C-1 through C-6 in Attachment C contain the reference data such as power ratings, load factors, and emission factors used for the calculations. The following durations for each portion of the vessel trip were assumed based upon a starting point approximately 11 miles west of the Golden Gate Bridge:

- 2 tugs operating 8 hours
- 6 hour transit time (duration of travel to terminal with the BAAQMD)
- 20 hour hoteling period (while the vessel loads)
- 4 hour maneuvering time (approach to terminal)

The emissions for each vessel trip were calculated and multiplied by the baseline year vessel calls (124) and projected lease period calls (120) to determine the baseline and lease period emissions.

Ten years of historical vessel call data was reviewed to determine the baseline operations year. The average number of vessel calls in the past ten years was 124 vessel calls. This was chosen as the baseline year to be compared to the projected maximum number of vessel calls over the lease renewal period of 120 vessel calls. Tables C-7 and C-8 in Attachment C calculate and compare the criteria and GHG baseline to lease period emissions.

Emissions from stationary sources were assumed to be negligible relative to the OGV emissions. Due to the decrease in the number of vessels from the baseline there are no increases in stationary emissions anticipated.

Attachment A

Construction Emissions Calculation Worksheets

Table A-3 Construction Emissions Estimation Input Data

Construction Phase	Phase Activity Description	Phase Start Date	Phase Completion Date	Workdays/Week	Estimated Number of Workers Onsite per Day	Estimated Number of Deliveries (Vendor) per Day	Types of Construction Equipment in Use	Number of Units for Each Piece of Equipment in Use	EPA Engine Tier	Horsepower	Fuel Type	Daily Operating Hours
Berth 1A Construction	Pile Driving, Set Caps, Set Modules, Concrete	8/1/15	5/10/16	5	35	8	Vibratory Hammer	1		625	Diesel	0-8
							Impact Hammer	1		N/A	Diesel	0-8
							**Small Derrick Barge	0	CA PERP Certified	440	Diesel	0
							**Large Derrick Barge	1	CA PERP Certified	700	Diesel	8-10
							Flat Deck barges	3		N/A	N/A	10
							Lg Crawler Cranes (230-250 to	0		360	Diesel	0
							Med Crawler Crane (165 ton ra	0		340	Diesel	0
							*Knuckle Boom Truck	1		170	Diesel	6-10
							*Pickups	14 - Modeled 5		300	Gasoline	2-14
							*Passenger Vans/Bus	3 - Not modeled		350	Gasoline	2-14
							*Telehandlers	4 - modeled 1		110	Diesel	8-10
							Hyd RT Cranes (55 ton range)	0		250	Diesel	0
							Large Air Compressors	2		200	Diesel	2-10
							*Total number of units for the entire site shown. Quantity is not additive between areas.					
							**Derrick barges have multiple engines. The horsepower listed is for the main hoist engine only. All engines on derrick barges are CA PERP (Portable Equipment Registration Program) certified.					
Area A and B Construction	Pile Repairs, New Bikeway, Isolation Stations	7/1/15	12/1/16	4	35	8	Vibratory Hammer	1		625	Diesel	0-8
							Impact Hammer	1		N/A	Diesel	0-8
							**Small Derrick Barge	0	CA PERP Certified	440	Diesel	0
							**Large Derrick Barge	0	CA PERP Certified	700	Diesel	0
							Flat Deck barges	0		N/A	N/A	0
							Lg Crawler Cranes (230-250 to	1		360	Diesel	8-10
							Med Crawler Crane (165 ton ra	1		340	Diesel	8-10
							*Knuckle Boom Truck	1		170	Diesel	10-Jun
							*Pickups	14 - Modeled 3		300	Gasoline	2-14
							*Passenger Vans/Bus	3 - Not modeled		350	Gasoline	2-14
							*Telehandlers	4 - modeled 1		110	Diesel	8-10
							Hyd RT Cranes (55 ton range)	0		250	Diesel	0
							Large Air Compressors	0		200	Diesel	0
							*Total number of units for the entire site shown. Quantity is not additive between areas.					
							**Derrick barges have multiple engines. The horsepower listed is for the main hoist engine only. All engines on derrick barges are CA PERP (Portable Equipment Registration Program) certified.					
Area C Construction	Pile Driving, Deck Panels, Concrete	5/15/15	8/30/16	5	35	8	Vibratory Hammer	1		625	Diesel	0-8
							Impact Hammer	1		N/A	Diesel	0-8
							**Small Derrick Barge	0	CA PERP Certified	440	Diesel	0
							**Large Derrick Barge	0	CA PERP Certified	700	Diesel	0
							Flat Deck barges	0		N/A	N/A	0
							Lg Crawler Cranes (230-250 to	1		360	Diesel	8-20
							Med Crawler Crane (165 ton ra	0		340	Diesel	0
							*Knuckle Boom Truck	1 - Modeled 1		170	Diesel	6-10
							*Pickups	14 - modeled 3		300	Gasoline	2-14
							*Passenger Vans/Bus	3 - Not modeled		350	Gasoline	2-14
							*Telehandlers	4 - modeled 1		110	Diesel	10-20
							Hyd RT Cranes (55 ton range)	1		250	Diesel	6-10
							Large Air Compressors	1		200	Diesel	2-20
							*Total number of units for the entire site shown. Quantity is not additive between areas.					
							**Derrick barges have multiple engines. The horsepower listed is for the main hoist engine only. All engines on derrick barges are CA PERP (Portable Equipment Registration Program) certified.					
							Vibratory Hammer	2		625	Diesel	0-8
							Impact Hammer	2		N/A	Diesel	0-8
							**Small Derrick Barge	1	CA PERP Certified	440	Diesel	8-10

Area D Construction	Pile Driving, Deck Panels, Concrete	8/1/15	7/5/16	5	35	8	**Large Derrick Barge	0	CA PERP Certified	700	Diesel	0
							Flat Deck barges	2		N/A	N/A	10
							Lg Crawler Cranes (230-250 to	2		360	Diesel	8-20
							Med Crawler Crane (165 ton ra	0		340	Diesel	0
							*Knuckle Boom Truck	1 - Modeled 0		170	Diesel	6-10
							*Pickups	14 - modeled 3		300	Gasoline	2-14
							*Passenger Vans/Bus	3 - Not modeled		350	Gasoline	2-14
							*Telehandlers	4 - modeled 1		110	Diesel	10-20
							Hyd RT Cranes (55 ton range)	1		250	Diesel	0
							Large Air Compressors	2		200	Diesel	2-20
							*Total number of units for the entire site shown. Quantity is not additive between areas.					
							**Derrick barges have multiple engines. The horsepower listed is for the main hoist engine only. All engines on derrick barges are CA PERP (Portable Equipment Registration Program) certified.					
Berth 5 Demolition	Pile Driving, Deck Panels, Concrete	1/1/17	7/1/17	5	20	5	Tug Boat (1000 HP)	1		1000	Diesel	0-8
							Tug Boat (500 HP)	1		500	Diesel	0-8
							Anchor Boat (500 HP)	1		500	Diesel	0-8
							Crane (20 ton)	1		100	Diesel	8
							Crane (200 ton)	1		500	Diesel	0-8
							Derrick Crane (100 HP)	1		100	Diesel	8
							Concrete Drill	2		50	Diesel	0-8
							Diamond Wire Saw	1		75	Diesel	0-8
							Excavator with Shear	1		300	Diesel	8
							Vibratory Pile Extractor	1		625	Diesel	8
							Excavator with Pulverizer	1		300	Diesel	8
							Excavator	1		250	Diesel	8
							Cement Mixer	0		0	n/a	0
							Generator	1		75	Diesel	8
							Dump Truck	2		450	Diesel	8
							Dive Support Equipment	1		150	Diesel	0-8
							Crew Vehicles	2		385	Gasoline	0-8

Construction Phase	Construction Phases					
Phase Activity	Provide a short					
Phase Start Date	Anticipated start date					
Phase Completion	Anticipated					
Workdays/Week	Number of days per					
Estimated Amount of Earthen Material Imported During	Amount (mass or volume) of earthen material (soil, fill, dirt)					
Estimated Amount of Earthen Material Exported During	Amount (mass or volume) of earthen material (soil, fill, dirt)					
Estimated Number of Workers Onsite per	Average number of construction workers					
Estimated Number of Deliveries (Vendor) per Day	Average number of deliveries (most commonly building					
Types of Construction Equipment in Use	List all equipment that will be used for that					
Number of Units for Each Piece of	How many pieces of each type of					
EPA Engine Tier	If the engine tier of					
Horsepower	If the engine					
Daily Operating Hours	operating hours of					

Table A-1 Construction Criteria Pollutant Summary						
Pollutant	**[1]2015 Emissions (tons/yr)**	**[1]2016 Emissions (tons/yr)**	**[1]2017 Emissions (tons/yr)**	**[2]Total 2015 Project Average Daily Emissions (lbs/day)**	**[3]Total 2016 Project Average Daily Emissions (lbs/day)**	**[4]Total 2017 Project Average Daily Emissions (lbs/day)**
ROG	1.00	1.16	0.25	8.7	6.9	10.4
NO_x	18.26	21.17	4.77	158.1	126.4	106.1
CO	13.14	15.40	3.37	113.8	91.9	77.4
Fugitive PM_{10}	0.19	0.24	0.03	1.6	1.4	0.3
Exhaust PM_{10}	0.54	0.63	0.16	4.7	3.8	3.4
Fugitive $PM_{2.5}$	0.05	0.06	0.01	0.2	0.4	0.1
Exhaust $PM_{2.5}$	0.52	0.61	0.15	4.5	3.6	1.7
SO_x	0.02	0.03	0.01	0.2	0.2	0.1

[1]Assumes all equipment will be certified to a minimum EPA Tier II Emission standard

[2]Average daily emissions calculated using 2015 duration which project activity was occuring; from 5/15/15-12/31/15 (231 days)

[3]Average daily emissions calculated using 2016 duration which project activity was occuring; from 1/1/16-12/1/16 (335 days)

[4]Average daily emissions calculated using 2017 duration which project activity was occuring; from 1/1/17-7/1/16 (181 days)

Table A-2 Construction GHG Emissions Summary		
2015 Total (MT CO_2e/year)	2016 Total (MT CO_2e/year)	2017 Total (MT CO_2e/year)
2,205	2,599	1,112

Emissions calculated using methodology from CARB Emissions Estimation Methodology for Commercial Harbor Craft Operating in California

.

	[10]Emission Factors (g/HP-hr)						
	NOx	PM	ROG	CO	[7]CO2	[8]N20	[8]CH4
500 HP	5.1	0.15	0.68	3.73	545.6	0.023	0.013
1000 HP	5.53	0.2	0.68	3.73	545.6	0.023	0.013

Table A-4 Construction Tug and Workboat Emissions								
	Criteria Emissions (lbs/day)				GHG Emissions (lbs/day)			Total
	NOx	PM	ROG	CO	CO2	N20	CH4	[9]MTCO2e/yr
1000 HP Tug	24.3	0.8	3.3	17.4	2978.5	0.1	0.1	247.7
500 HP Tug	22.4	0.6	3.3	17.4	2978.5	0.1	0.1	247.7
500 HP Anchor Boat	6.8	0.2	1.0	5.3	934.0	0.04	0.02	77.7
Total	**53.4**	**1.6**	**7.6**	**40.1**	**6890.9**	**0.3**	**0.2**	**573.1**

[1] *F:*	NOX	PM
	0.948	0.8

[2] *D:*	NOx	PM	ROG	CO
	0.21	0.67	0.44	0.25

[3] *A (years):*	5

[4] *UL (years):*	Tug Boats	Work Boats
	21	17

[5] *LF:*	Tug Boat Main Engine	Work Boat Main Engine
	0.5	0.15

[6] *Hr:*	Tug Boat	Work Boat
	4	4

The basic equation for the estimating emissions from a commercial harbor craft engine is:

$$E = EF_0 \times F \times (1 + D \times \frac{A}{UL}) \times HP \times LF \times Hr$$

Where:

E is the amount of emissions of a pollutant (ROG, CO, NOx, or PM) emitted during one period; [7]

EF₀ is the model year, horsepower and engine use (propulsion or auxiliary) specific zero hour emission factor (when engine is new);

F is the fuel correction factor which accounts for emission reduction benefits from burning cleaner fuel;

D is the horsepower and pollutant specific engine deterioration factor, which is the percentage increase of emission factors at the end of the useful life of the engine;

A is the age of the engine when the emissions are estimated;

UL is the vessel type and engine use specific engine useful life;

HP is rated horsepower of the engine;

LF is the vessel type and engine use specific engine load factor;

Hr is the number of annual operating hours of the engine.

[1]Fuel correction factor applies for all engines greater than 176 HP
[2]Engine Deterioration Factor applies for all engines greater than 251 HP
[3]Engines were assumed to be 5 years old
[4]Useful life estimates from Table II-2 of CARB emissions estimation guidance
[5]Engine load factors from Table II-3 of CARB emissions estimation guidance
[6]Daily operating hours used to estimate daily emissions
[7]CO2 emission factor from Appendix G - Assumptions for Estimating Greenhouse Gas Emissions from Commercial Harbor Craft Operating in California
[8]N2O and CH4 emission factors from Port of Long Beach Air Emissions Inventory - 2011
[9]Assumes CH4 GWP = 25 N2O GWP = 298 and duration of Berth 5 demolition is 181 days
[10]Emission factors from Appendix A of the CARB Commercial Harborcraft Guidance

Attachment B

CalEEMod Modeling Results

Avon Marine Oil Terminal Construction

Bay Area AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	0.00	User Defined Unit	0.00	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	64
Climate Zone	5			**Operational Year**	2017
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use -

Construction Phase - Non-default values entered.

Off-road Equipment - Non-default value entered

Off-road Equipment - Non-default values entered

Off-road Equipment - non-default values entered

Off-road Equipment - Non-default values entered

Off-road Equipment - Non-default values entered

Trips and VMT - Non-default values entered.

Construction Off-road Equipment Mitigation - Non-default values entered

Table Name	Column Name	Default Value	New Value

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	17.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstructionPhase	NumDays	0.00	338.00
tblConstructionPhase	NumDays	0.00	372.00
tblConstructionPhase	NumDays	0.00	242.00
tblConstructionPhase	NumDays	0.00	202.00
tblConstructionPhase	NumDays	0.00	130.00
tblConstructionPhase	PhaseEndDate	2/1/2018	12/1/2016
tblConstructionPhase	PhaseEndDate	11/6/2017	7/5/2016
tblConstructionPhase	PhaseEndDate	4/13/2017	5/10/2016
tblConstructionPhase	PhaseEndDate	11/8/2016	6/30/2017
tblConstructionPhase	PhaseStartDate	8/31/2016	7/1/2015
tblConstructionPhase	PhaseStartDate	12/2/2016	8/1/2015
tblConstructionPhase	PhaseStartDate	7/6/2016	8/1/2015
tblConstructionPhase	PhaseStartDate	5/11/2016	1/1/2017

tblOffRoadEquipment	HorsePower	81.00	50.00
tblOffRoadEquipment	HorsePower	81.00	75.00
tblOffRoadEquipment	HorsePower	226.00	360.00
tblOffRoadEquipment	HorsePower	226.00	250.00
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tblOffRoadEquipment	HorsePower	171.00	625.00

tblOffRoadEquipment	HorsePower	171.00	625.00
tblOffRoadEquipment	HorsePower	171.00	625.00
tblOffRoadEquipment	HorsePower	171.00	625.00
tblOffRoadEquipment	HorsePower	171.00	625.00
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tblOffRoadEquipment	UsageHours	4.00	9.00
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tblOffRoadEquipment	UsageHours	8.00	9.00
tblOffRoadEquipment	UsageHours	8.00	15.00
tblOffRoadEquipment	UsageHours	8.00	9.00
tblProjectCharacteristics	OperationalYear	2014	2017
tblTripsAndVMT	VendorTripNumber	0.00	16.00
tblTripsAndVMT	VendorTripNumber	0.00	16.00
tblTripsAndVMT	VendorTripNumber	0.00	16.00
tblTripsAndVMT	VendorTripNumber	0.00	16.00
tblTripsAndVMT	VendorTripNumber	0.00	10.00
tblTripsAndVMT	WorkerTripNumber	0.00	70.00

tblTripsAndVMT	WorkerTripNumber	0.00	70.00
tblTripsAndVMT	WorkerTripNumber	0.00	70.00
tblTripsAndVMT	WorkerTripNumber	0.00	70.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.8459	20.6228	12.0639	0.0238	0.1900	0.8423	1.0323	0.0511	0.7806	0.8317	0.0000	2,193.8911	2,193.8911	0.5201	0.0000	2,204.8124
2016	2.0619	22.6440	13.9335	0.0283	0.2358	0.9271	1.1629	0.0634	0.8584	0.9218	0.0000	2,585.8075	2,585.8075	0.6226	0.0000	2,598.8811
2017	0.4749	4.5505	2.7203	5.9500e-003	0.0278	0.2187	0.2465	7.4700e-003	0.2044	0.2119	0.0000	536.1659	536.1659	0.1414	0.0000	539.1354
Total	**4.3827**	**47.8173**	**28.7177**	**0.0580**	**0.4536**	**1.9881**	**2.4417**	**0.1220**	**1.8433**	**1.9653**	**0.0000**	**5,315.8644**	**5,315.8644**	**1.2840**	**0.0000**	**5,342.8289**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.0028	18.2584	13.1410	0.0238	0.1900	0.5432	0.7332	0.0511	0.5244	0.5755	0.0000	2,193.8888	2,193.8888	0.5201	0.0000	2,204.8101
2016	1.1602	21.1681	15.4010	0.0283	0.2358	0.6288	0.8645	0.0634	0.6072	0.6706	0.0000	2,585.8048	2,585.8048	0.6226	0.0000	2,598.8783
2017	0.2496	4.7687	3.3704	5.9500e-003	0.0278	0.1579	0.1856	7.4700e-003	0.1533	0.1608	0.0000	536.1653	536.1653	0.1414	0.0000	539.1348

Total	**2.4126**	**44.1952**	**31.9123**	**0.0580**	**0.4536**	**1.3299**	**1.7834**	**0.1220**	**1.2849**	**1.4069**	**0.0000**	**5,315.8588**	**5,315.8588**	**1.2840**	**0.0000**	**5,342.8232**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**44.95**	**7.57**	**-11.12**	**0.00**	**0.00**	**33.11**	**26.96**	**0.00**	**30.29**	**28.41**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Area C Construction	Building Construction	5/15/2015	8/30/2016	5	338	Pile Driving, set caps, set modules, concrete
2	Area A & B Construction	Building Construction	7/1/2015	12/1/2016	5	372	Pile repairs, new bikeway, isolation stations
3	Area D Construction	Building Construction	8/1/2015	7/5/2016	5	242	Pile Driving, Deck panels, concrete
4	Berth 1A Construction	Building Construction	8/1/2015	5/10/2016	5	202	Pile driving, set caps, set modules, concrete
5	Berth 5 Demolition	Demolition	1/1/2017	6/30/2017	5	130	Removal of Berth 5

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Area C Construction	Air Compressors	1	11.00	200	0.48

Area C Construction	Cranes	1	14.00	360	0.29
Area C Construction	Cranes	1	8.00	250	0.29
Area C Construction	Off-Highway Trucks	1	2.00	170	0.38
Area C Construction	Off-Highway Trucks	3	8.00	300	0.38
Area C Construction	Other Construction Equipment	1	4.00	625	0.42
Area C Construction	Tractors/Loaders/Backhoes	1	15.00	110	0.37
Area A & B Construction	Cranes	1	9.00	360	0.29
Area A & B Construction	Cranes	1	9.00	340	0.29
Area A & B Construction	Off-Highway Trucks	3	8.00	300	0.38
Area A & B Construction	Off-Highway Trucks	1	2.00	170	0.38
Area A & B Construction	Other Construction Equipment	1	4.00	625	0.42
Area A & B Construction	Tractors/Loaders/Backhoes	1	9.00	110	0.37
Area D Construction	Air Compressors	2	11.00	200	0.48
Area D Construction	Cranes	2	14.00	360	0.29
Area D Construction	Off-Highway Trucks	1	2.00	170	0.38
Area D Construction	Off-Highway Trucks	3	8.00	300	0.38
Area D Construction	Other Construction Equipment	1	4.00	625	0.42
Area D Construction	Other General Industrial Equipment	1	9.00	440	0.34
Area D Construction	Tractors/Loaders/Backhoes	1	15.00	110	0.37
Berth 1A Construction	Air Compressors	2	6.00	200	0.48
Berth 1A Construction	Off-Highway Trucks	1	2.00	170	0.38
Berth 1A Construction	Off-Highway Trucks	5	8.00	300	0.38
Berth 1A Construction	Other Construction Equipment	1	4.00	625	0.42
Berth 1A Construction	Other General Industrial Equipment	1	9.00	700	0.34
Berth 1A Construction	Tractors/Loaders/Backhoes	1	9.00	110	0.37
Berth 5 Demolition	Concrete/Industrial Saws	2	4.00	50	0.73
Berth 5 Demolition	Concrete/Industrial Saws	1	4.00	75	0.73
Berth 5 Demolition	Cranes	2	8.00	100	0.29
Berth 5 Demolition	Cranes	1	4.00	500	0.29
Berth 5 Demolition	Cranes	1	8.00	100	0.29
Berth 5 Demolition	Excavators	2	8.00	300	0.38

Berth 5 Demolition	Excavators	1	8.00	250	0.38
Berth 5 Demolition	Generator Sets	1	8.00	75	0.74
Berth 5 Demolition	Off-Highway Trucks	1	8.00	450	0.38
Berth 5 Demolition	Off-Highway Trucks	2	4.00	385	0.38
Berth 5 Demolition	Other Construction Equipment	1	8.00	625	0.42
Berth 5 Demolition	Other Construction Equipment	1	4.00	150	0.42

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Area C Construction	9	70.00	16.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Area A & B Construction	8	70.00	16.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Area D Construction	11	70.00	16.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Berth 1A Construction	11	70.00	16.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Berth 5 Demolition	16	40.00	10.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Clean Paved Roads

3.2 Area C Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.5337	6.1692	3.1252	6.0700e-003		0.2672	0.2672		0.2477	0.2477	0.0000	567.1758	567.1758	0.1457	0.0000	570.2352
Total	**0.5337**	**6.1692**	**3.1252**	**6.0700e-003**		**0.2672**	**0.2672**		**0.2477**	**0.2477**	**0.0000**	**567.1758**	**567.1758**	**0.1457**	**0.0000**	**570.2352**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0189	0.1521	0.2093	3.2000e-004	8.5000e-003	2.4700e-003	0.0110	2.4400e-003	2.2700e-003	4.7000e-003	0.0000	28.8818	28.8818	2.6000e-004	0.0000	28.8873
Worker	0.0245	0.0354	0.3442	6.2000e-004	0.0524	4.6000e-004	0.0529	0.0139	4.2000e-004	0.0144	0.0000	49.2248	49.2248	2.8700e-003	0.0000	49.2852
Total	**0.0434**	**0.1876**	**0.5535**	**9.4000e-004**	**0.0609**	**2.9300e-003**	**0.0638**	**0.0164**	**2.6900e-003**	**0.0191**	**0.0000**	**78.1066**	**78.1066**	**3.1300e-003**	**0.0000**	**78.1724**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2793	5.3366	3.3530	6.0700e-003		0.1703	0.1703		0.1637	0.1637	0.0000	567.1751	567.1751	0.1457	0.0000	570.2345
Total	**0.2793**	**5.3366**	**3.3530**	**6.0700e-003**		**0.1703**	**0.1703**		**0.1637**	**0.1637**	**0.0000**	**567.1751**	**567.1751**	**0.1457**	**0.0000**	**570.2345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0189	0.1521	0.2093	3.2000e-004	8.5000e-003	2.4700e-003	0.0110	2.4400e-003	2.2700e-003	4.7000e-003	0.0000	28.8818	28.8818	2.6000e-004	0.0000	28.8873
Worker	0.0245	0.0354	0.3442	6.2000e-004	0.0524	4.6000e-004	0.0529	0.0139	4.2000e-004	0.0144	0.0000	49.2248	49.2248	2.8700e-003	0.0000	49.2852
Total	**0.0434**	**0.1876**	**0.5535**	**9.4000e-004**	**0.0609**	**2.9300e-003**	**0.0638**	**0.0164**	**2.6900e-003**	**0.0191**	**0.0000**	**78.1066**	**78.1066**	**3.1300e-003**	**0.0000**	**78.1724**

3.2 Area C Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.5223	5.9315	3.1050	6.3600e-003		0.2561	0.2561		0.2374	0.2374	0.0000	589.2701	589.2701	0.1523	0.0000	592.4679
Total	**0.5223**	**5.9315**	**3.1050**	**6.3600e-003**		**0.2561**	**0.2561**		**0.2374**	**0.2374**	**0.0000**	**589.2701**	**589.2701**	**0.1523**	**0.0000**	**592.4679**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0176	0.1387	0.2047	3.3000e-004	8.9100e-003	2.0700e-003	0.0110	2.5600e-003	1.9000e-003	4.4600e-003	0.0000	29.9303	29.9303	2.4000e-004	0.0000	29.9353

Worker	0.0230	0.0333	0.3223	6.5000e-004	0.0549	4.6000e-004	0.0554	0.0146	4.2000e-004	0.0150	0.0000	49.8443	49.8443	2.7500e-003	0.0000	49.9020
Total	**0.0406**	**0.1720**	**0.5270**	**9.8000e-004**	**0.0638**	**2.5300e-003**	**0.0664**	**0.0172**	**2.3200e-003**	**0.0195**	**0.0000**	**79.7746**	**79.7746**	**2.9900e-003**	**0.0000**	**79.8373**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2819	5.4387	3.4557	6.3600e-003		0.1715	0.1715		0.1651	0.1651	0.0000	589.2694	589.2694	0.1523	0.0000	592.4672
Total	**0.2819**	**5.4387**	**3.4557**	**6.3600e-003**		**0.1715**	**0.1715**		**0.1651**	**0.1651**	**0.0000**	**589.2694**	**589.2694**	**0.1523**	**0.0000**	**592.4672**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0176	0.1387	0.2047	3.3000e-004	8.9100e-003	2.0700e-003	0.0110	2.5600e-003	1.9000e-003	4.4600e-003	0.0000	29.9303	29.9303	2.4000e-004	0.0000	29.9353
Worker	0.0230	0.0333	0.3223	6.5000e-004	0.0549	4.6000e-004	0.0554	0.0146	4.2000e-004	0.0150	0.0000	49.8443	49.8443	2.7500e-003	0.0000	49.9020
Total	**0.0406**	**0.1720**	**0.5270**	**9.8000e-004**	**0.0638**	**2.5300e-003**	**0.0664**	**0.0172**	**2.3200e-003**	**0.0195**	**0.0000**	**79.7746**	**79.7746**	**2.9900e-003**	**0.0000**	**79.8373**

3.3 Area A & B Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3192	3.8155	2.1731	3.6000e-003		0.1642	0.1642		0.1510	0.1510	0.0000	343.2707	343.2707	0.1025	0.0000	345.4228
Total	**0.3192**	**3.8155**	**2.1731**	**3.6000e-003**		**0.1642**	**0.1642**		**0.1510**	**0.1510**	**0.0000**	**343.2707**	**343.2707**	**0.1025**	**0.0000**	**345.4228**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0151	0.1217	0.1674	2.5000e-004	6.8000e-003	1.9700e-003	8.7700e-003	1.9500e-003	1.8100e-003	3.7600e-003	0.0000	23.1055	23.1055	2.1000e-004	0.0000	23.1098
Worker	0.0196	0.0283	0.2754	5.0000e-004	0.0419	3.7000e-004	0.0423	0.0112	3.4000e-004	0.0115	0.0000	39.3799	39.3799	2.3000e-003	0.0000	39.4281
Total	**0.0347**	**0.1500**	**0.4428**	**7.5000e-004**	**0.0487**	**2.3400e-003**	**0.0511**	**0.0131**	**2.1500e-003**	**0.0153**	**0.0000**	**62.4853**	**62.4853**	**2.5100e-003**	**0.0000**	**62.5379**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	0.1695	3.2294	2.1498	3.6000e-003		0.1035	0.1035		0.0992	0.0992	0.0000	343.2703	343.2703	0.1025	0.0000	345.4224
Total	**0.1695**	**3.2294**	**2.1498**	**3.6000e-003**		**0.1035**	**0.1035**		**0.0992**	**0.0992**	**0.0000**	**343.2703**	**343.2703**	**0.1025**	**0.0000**	**345.4224**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0151	0.1217	0.1674	2.5000e-004	6.8000e-003	1.9700e-003	8.7700e-003	1.9500e-003	1.8100e-003	3.7600e-003	0.0000	23.1055	23.1055	2.1000e-004	0.0000	23.1098
Worker	0.0196	0.0283	0.2754	5.0000e-004	0.0419	3.7000e-004	0.0423	0.0112	3.4000e-004	0.0115	0.0000	39.3799	39.3799	2.3000e-003	0.0000	39.4281
Total	**0.0347**	**0.1500**	**0.4428**	**7.5000e-004**	**0.0487**	**2.3400e-003**	**0.0511**	**0.0131**	**2.1500e-003**	**0.0153**	**0.0000**	**62.4853**	**62.4853**	**2.5100e-003**	**0.0000**	**62.5379**

3.3 Area A & B Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.5367	6.3174	3.7055	6.5500e-003		0.2704	0.2704		0.2488	0.2488	0.0000	617.2718	617.2718	0.1862	0.0000	621.1818
Total	**0.5367**	**6.3174**	**3.7055**	**6.5500e-003**		**0.2704**	**0.2704**		**0.2488**	**0.2488**	**0.0000**	**617.2718**	**617.2718**	**0.1862**	**0.0000**	**621.1818**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0244	0.1924	0.2840	4.6000e-004	0.0124	2.8700e-003	0.0152	3.5400e-003	2.6400e-003	6.1800e-003	0.0000	41.5218	41.5218	3.3000e-004	0.0000	41.5288
Worker	0.0319	0.0462	0.4471	9.1000e-004	0.0762	6.4000e-004	0.0768	0.0203	5.8000e-004	0.0209	0.0000	69.1482	69.1482	3.8100e-003	0.0000	69.2282
Total	**0.0563**	**0.2386**	**0.7311**	**1.3700e-003**	**0.0886**	**3.5100e-003**	**0.0921**	**0.0238**	**3.2200e-003**	**0.0270**	**0.0000**	**110.6700**	**110.6700**	**4.1400e-003**	**0.0000**	**110.7569**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2946	5.6773	3.8196	6.5500e-003		0.1795	0.1795		0.1723	0.1723	0.0000	617.2711	617.2711	0.1862	0.0000	621.1811
Total	**0.2946**	**5.6773**	**3.8196**	**6.5500e-003**		**0.1795**	**0.1795**		**0.1723**	**0.1723**	**0.0000**	**617.2711**	**617.2711**	**0.1862**	**0.0000**	**621.1811**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0244	0.1924	0.2840	4.6000e-004	0.0124	2.8700e-003	0.0152	3.5400e-003	2.6400e-003	6.1800e-003	0.0000	41.5218	41.5218	3.3000e-004	0.0000	41.5288
Worker	0.0319	0.0462	0.4471	9.1000e-004	0.0762	6.4000e-004	0.0768	0.0203	5.8000e-004	0.0209	0.0000	69.1482	69.1482	3.8100e-003	0.0000	69.2282
Total	**0.0563**	**0.2386**	**0.7311**	**1.3700e-003**	**0.0886**	**3.5100e-003**	**0.0921**	**0.0238**	**3.2200e-003**	**0.0270**	**0.0000**	**110.6700**	**110.6700**	**4.1400e-003**	**0.0000**	**110.7569**

3.4 Area D Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4967	5.8389	3.1486	6.0700e-003		0.2391	0.2391		0.2225	0.2225	0.0000	564.3271	564.3271	0.1372	0.0000	567.2092
Total	**0.4967**	**5.8389**	**3.1486**	**6.0700e-003**		**0.2391**	**0.2391**		**0.2225**	**0.2225**	**0.0000**	**564.3271**	**564.3271**	**0.1372**	**0.0000**	**567.2092**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0125	0.1005	0.1383	2.1000e-004	5.6100e-003	1.6300e-003	7.2400e-003	1.6100e-003	1.5000e-003	3.1100e-003	0.0000	19.0795	19.0795	1.7000e-004	0.0000	19.0831
Worker	0.0162	0.0234	0.2274	4.1000e-004	0.0346	3.1000e-004	0.0349	9.2100e-003	2.8000e-004	9.4900e-003	0.0000	32.5182	32.5182	1.9000e-003	0.0000	32.5581
Total	**0.0286**	**0.1239**	**0.3656**	**6.2000e-004**	**0.0402**	**1.9400e-003**	**0.0422**	**0.0108**	**1.7800e-003**	**0.0126**	**0.0000**	**51.5977**	**51.5977**	**2.0700e-003**	**0.0000**	**51.6412**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2515	5.1208	3.3363	6.0700e-003		0.1535	0.1535		0.1484	0.1484	0.0000	564.3264	564.3264	0.1372	0.0000	567.2085
Total	**0.2515**	**5.1208**	**3.3363**	**6.0700e-003**		**0.1535**	**0.1535**		**0.1484**	**0.1484**	**0.0000**	**564.3264**	**564.3264**	**0.1372**	**0.0000**	**567.2085**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0125	0.1005	0.1383	2.1000e-004	5.6100e-003	1.6300e-003	7.2400e-003	1.6100e-003	1.5000e-003	3.1100e-003	0.0000	19.0795	19.0795	1.7000e-004	0.0000	19.0831
Worker	0.0162	0.0234	0.2274	4.1000e-004	0.0346	3.1000e-004	0.0349	9.2100e-003	2.8000e-004	9.4900e-003	0.0000	32.5182	32.5182	1.9000e-003	0.0000	32.5581
Total	**0.0286**	**0.1239**	**0.3656**	**6.2000e-004**	**0.0402**	**1.9400e-003**	**0.0422**	**0.0108**	**1.7800e-003**	**0.0126**	**0.0000**	**51.5977**	**51.5977**	**2.0700e-003**	**0.0000**	**51.6412**

3.4 Area D Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Off-Road	0.5666	6.5121	3.6393	7.4100e-003		0.2666	0.2666		0.2480	0.2480	0.0000	682.9014	682.9014	0.1668	0.0000	686.4047
Total	**0.5666**	**6.5121**	**3.6393**	**7.4100e-003**		**0.2666**	**0.2666**		**0.2480**	**0.2480**	**0.0000**	**682.9014**	**682.9014**	**0.1668**	**0.0000**	**686.4047**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0135	0.1066	0.1574	2.5000e-004	6.8500e-003	1.5900e-003	8.4400e-003	1.9600e-003	1.4600e-003	3.4300e-003	0.0000	23.0100	23.0100	1.8000e-004	0.0000	23.0139
Worker	0.0177	0.0256	0.2478	5.0000e-004	0.0422	3.5000e-004	0.0426	0.0112	3.2000e-004	0.0116	0.0000	38.3196	38.3196	2.1100e-003	0.0000	38.3639
Total	**0.0312**	**0.1322**	**0.4052**	**7.5000e-004**	**0.0491**	**1.9400e-003**	**0.0510**	**0.0132**	**1.7800e-003**	**0.0150**	**0.0000**	**61.3296**	**61.3296**	**2.2900e-003**	**0.0000**	**61.3778**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2951	6.0743	3.9976	7.4100e-003		0.1799	0.1799		0.1741	0.1741	0.0000	682.9006	682.9006	0.1668	0.0000	686.4039
Total	**0.2951**	**6.0743**	**3.9976**	**7.4100e-003**		**0.1799**	**0.1799**		**0.1741**	**0.1741**	**0.0000**	**682.9006**	**682.9006**	**0.1668**	**0.0000**	**686.4039**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0135	0.1066	0.1574	2.5000e-004	6.8500e-003	1.5900e-003	8.4400e-003	1.9600e-003	1.4600e-003	3.4300e-003	0.0000	23.0100	23.0100	1.8000e-004	0.0000	23.0139
Worker	0.0177	0.0256	0.2478	5.0000e-004	0.0422	3.5000e-004	0.0426	0.0112	3.2000e-004	0.0116	0.0000	38.3196	38.3196	2.1100e-003	0.0000	38.3639
Total	**0.0312**	**0.1322**	**0.4052**	**7.5000e-004**	**0.0491**	**1.9400e-003**	**0.0510**	**0.0132**	**1.7800e-003**	**0.0150**	**0.0000**	**61.3296**	**61.3296**	**2.2900e-003**	**0.0000**	**61.3778**

3.5 Berth 1A Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3610	4.2139	1.8894	5.0700e-003		0.1627	0.1627		0.1510	0.1510	0.0000	475.3302	475.3302	0.1249	0.0000	477.9525
Total	**0.3610**	**4.2139**	**1.8894**	**5.0700e-003**		**0.1627**	**0.1627**		**0.1510**	**0.1510**	**0.0000**	**475.3302**	**475.3302**	**0.1249**	**0.0000**	**477.9525**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0125	0.1005	0.1383	2.1000e-004	5.6100e-003	1.6300e-003	7.2400e-003	1.6100e-003	1.5000e-003	3.1100e-003	0.0000	19.0795	19.0795	1.7000e-004	0.0000	19.0831
Worker	0.0162	0.0234	0.2274	4.1000e-004	0.0346	3.1000e-004	0.0349	9.2100e-003	2.8000e-004	9.4900e-003	0.0000	32.5182	32.5182	1.9000e-003	0.0000	32.5581
Total	**0.0286**	**0.1239**	**0.3656**	**6.2000e-004**	**0.0402**	**1.9400e-003**	**0.0422**	**0.0108**	**1.7800e-003**	**0.0126**	**0.0000**	**51.5977**	**51.5977**	**2.0700e-003**	**0.0000**	**51.6412**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1672	3.9862	2.5743	5.0700e-003		0.1068	0.1068		0.1048	0.1048	0.0000	475.3296	475.3296	0.1249	0.0000	477.9519
Total	**0.1672**	**3.9862**	**2.5743**	**5.0700e-003**		**0.1068**	**0.1068**		**0.1048**	**0.1048**	**0.0000**	**475.3296**	**475.3296**	**0.1249**	**0.0000**	**477.9519**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0125	0.1005	0.1383	2.1000e-004	5.6100e-003	1.6300e-003	7.2400e-003	1.6100e-003	1.5000e-003	3.1100e-003	0.0000	19.0795	19.0795	1.7000e-004	0.0000	19.0831
Worker	0.0162	0.0234	0.2274	4.1000e-004	0.0346	3.1000e-004	0.0349	9.2100e-003	2.8000e-004	9.4900e-003	0.0000	32.5182	32.5182	1.9000e-003	0.0000	32.5581

Total	**0.0286**	**0.1239**	**0.3656**	**6.2000e-004**	**0.0402**	**1.9400e-003**	**0.0422**	**0.0108**	**1.7800e-003**	**0.0126**	**0.0000**	**51.5977**	**51.5977**	**2.0700e-003**	**0.0000**	**51.6412**

3.5 Berth 1A Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2865	3.2477	1.5371	4.3300e-003		0.1246	0.1246		0.1157	0.1157	0.0000	401.7054	401.7054	0.1062	0.0000	403.9363
Total	**0.2865**	**3.2477**	**1.5371**	**4.3300e-003**		**0.1246**	**0.1246**		**0.1157**	**0.1157**	**0.0000**	**401.7054**	**401.7054**	**0.1062**	**0.0000**	**403.9363**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.4700e-003	0.0746	0.1101	1.8000e-004	4.7900e-003	1.1100e-003	5.9000e-003	1.3700e-003	1.0200e-003	2.4000e-003	0.0000	16.0897	16.0897	1.3000e-004	0.0000	16.0924
Worker	0.0123	0.0179	0.1733	3.5000e-004	0.0295	2.5000e-004	0.0298	7.8500e-003	2.3000e-004	8.0800e-003	0.0000	26.7949	26.7949	1.4800e-003	0.0000	26.8259
Total	**0.0218**	**0.0925**	**0.2833**	**5.3000e-004**	**0.0343**	**1.3600e-003**	**0.0357**	**9.2200e-003**	**1.2500e-003**	**0.0105**	**0.0000**	**42.8846**	**42.8846**	**1.6100e-003**	**0.0000**	**42.9183**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1387	3.3426	2.1814	4.3300e-003		0.0886	0.0886		0.0871	0.0871	0.0000	401.7049	401.7049	0.1062	0.0000	403.9358
Total	**0.1387**	**3.3426**	**2.1814**	**4.3300e-003**		**0.0886**	**0.0886**		**0.0871**	**0.0871**	**0.0000**	**401.7049**	**401.7049**	**0.1062**	**0.0000**	**403.9358**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	9.4700e-003	0.0746	0.1101	1.8000e-004	4.7900e-003	1.1100e-003	5.9000e-003	1.3700e-003	1.0200e-003	2.4000e-003	0.0000	16.0897	16.0897	1.3000e-004	0.0000	16.0924
Worker	0.0123	0.0179	0.1733	3.5000e-004	0.0295	2.5000e-004	0.0298	7.8500e-003	2.3000e-004	8.0800e-003	0.0000	26.7949	26.7949	1.4800e-003	0.0000	26.8259
Total	**0.0218**	**0.0925**	**0.2833**	**5.3000e-004**	**0.0343**	**1.3600e-003**	**0.0357**	**9.2200e-003**	**1.2500e-003**	**0.0105**	**0.0000**	**42.8846**	**42.8846**	**1.6100e-003**	**0.0000**	**42.9183**

3.6 Berth 5 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4587	4.4794	2.5068	5.5100e-003		0.2177	0.2177		0.2034	0.2034	0.0000	501.7583	501.7583	0.1402	0.0000	504.7030
Total	**0.4587**	**4.4794**	**2.5068**	**5.5100e-003**		**0.2177**	**0.2177**		**0.2034**	**0.2034**	**0.0000**	**501.7583**	**501.7583**	**0.1402**	**0.0000**	**504.7030**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	7.5000e-003	0.0584	0.0904	1.5000e-004	4.1800e-003	8.4000e-004	5.0200e-003	1.2000e-003	7.7000e-004	1.9700e-003	0.0000	13.8196	13.8196	1.1000e-004	0.0000	13.8219
Worker	8.7500e-003	0.0128	0.1231	2.8000e-004	0.0236	1.9000e-004	0.0238	6.2700e-003	1.7000e-004	6.4500e-003	0.0000	20.5880	20.5880	1.0800e-003	0.0000	20.6106
Total	**0.0163**	**0.0712**	**0.2135**	**4.3000e-004**	**0.0278**	**1.0300e-003**	**0.0288**	**7.4700e-003**	**9.4000e-004**	**8.4200e-003**	**0.0000**	**34.4076**	**34.4076**	**1.1900e-003**	**0.0000**	**34.4325**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2334	4.6976	3.1569	5.5100e-003		0.1569	0.1569		0.1524	0.1524	0.0000	501.7577	501.7577	0.1402	0.0000	504.7024
Total	**0.2334**	**4.6976**	**3.1569**	**5.5100e-003**		**0.1569**	**0.1569**		**0.1524**	**0.1524**	**0.0000**	**501.7577**	**501.7577**	**0.1402**	**0.0000**	**504.7024**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	7.5000e-003	0.0584	0.0904	1.5000e-004	4.1800e-003	8.4000e-004	5.0200e-003	1.2000e-003	7.7000e-004	1.9700e-003	0.0000	13.8196	13.8196	1.1000e-004	0.0000	13.8219
Worker	8.7500e-003	0.0128	0.1231	2.8000e-004	0.0236	1.9000e-004	0.0238	6.2700e-003	1.7000e-004	6.4500e-003	0.0000	20.5880	20.5880	1.0800e-003	0.0000	20.6106
Total	**0.0163**	**0.0712**	**0.2135**	**4.3000e-004**	**0.0278**	**1.0300e-003**	**0.0288**	**7.4700e-003**	**9.4000e-004**	**8.4200e-003**	**0.0000**	**34.4076**	**34.4076**	**1.1900e-003**	**0.0000**	**34.4325**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles	Trip %	Trip Purpose %

Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.546114	0.062902	0.174648	0.122995	0.034055	0.004856	0.015640	0.024397	0.002087	0.003279	0.006673	0.000688	0.001667

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					

User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					

Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Industrial	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Industrial	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000

Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Attachment C

Operational Emissions Calculation Worksheets

Table C-1: Average Vessel Power Rating (kW)			
	Main Power	Aux Power	Boiler Power
[1]Tanker	13034	2339	1593
[2]Tug	745.699		

Table C-2 : Load Factors			
	Hoteling	**Manuevering**	**Transit**
[3]Tanker	26%	33%	24%
[4]Tug	n/a	n/a	50%

Table C-3: [5]Tanker Main Engine Emission Factors - Maneuvering and Transit Mode (g/kW-hr)									[11]N2O	[11]CH4
Engine Speed	Fuel	CO	CO2	NOx	PM10	PM2.5	ROG	SOx		
Slow	MDO (0.1% S)	1.1	588	17	0.25	0.23	0.78	0.36	0.031	0.012
Slow	MDO(0.5% S)	1.1	588	17	0.38	0.35	0.78	1.9	0.031	0.012
Slow	Heavy Fuel Oil	1.38	620	18.1	1.5	1.46	0.69	10.5	0.031	0.012
Medium	MDO (0.1% S)	1.1	645	13.2	0.25	0.23	0.65	0.4	0.031	0.01
Medium	MDO(0.5% S)	1.1	645	13.2	0.38	0.35	0.65	2.08	0.031	0.01
Medium	Heavy Fuel Oil	1.1	677	14	1.5	1.46	0.57	11.5	0.031	0.01
High	MDO (0.1% S)	1.1	645	12.1	0.25	0.23	0.65	0.4	0.031	0.01
High	MDO(0.5% S)	1.1	645	12.1	0.38	0.35	0.65	20.8	0.031	0.01
High	Heavy Fuel Oil	1.1	645	12.7	1.5	1.46	0.23	11.5	0.031	0.01

Table C-4: [6]Tanker Auxiliary Engine Emission Factors - Transit, Maneuvering, and Hotelling (g/kW-hr)										
Engine Speed	Fuel	CO	CO2	NOx	PM10	PM2.5	ROG	SOx	N2O	CH4
Medium	MDO (0.1% S)	1.1	690	13.9	0.25	0.23	0.52	0.4	0.031	0.008
Medium	MDO(0.5% S)	1.1	690	13.9	0.38	0.35	0.52	2.1	0.031	0.008
Medium	Heavy Fuel Oil	1.1	722	14.7	1.5	1.46	0.46	11.1	0.031	0.008

Table C-5: [7]Tanker Auxiliary Bioler Emission Factors (g/kW-hr)									
Fuel	CO	CO2	NOx	PM10	PM2.5	ROG	SOx	N2O	CH4
Heavy Fuel Oil	0.2	970	2.1	0.8	0.78	0.11	16.5	0.08	0.002

Table C-6: Tug Main Engine Emission Factors Transit Mode (g/kW-hr)								
[9]CO	[10]CO2	[9]NOx	[9]PM10	[8]PM2.5	[9]ROG	[8]SOx	N2O	CH4
5.002682	731.7596567	7.416845494	0.268240343	0.38	0.912017	2.08	0.031	0.018

[1]Tanker power rankings from Table II-4 of CARB. Emissions Estimation Methodology for Ocean-Going Vessels, May 2011

[2]Tug primary power assumed to be 1000 HP or 745 kW

[3]Tanker factors from Table II-5 of CARB. Emissions Estimation Methodology for Ocean-Going Vessels, May 2011

[4]Tug load factors from Table II-3 of CARB Emissions Estimation Methodology for Commercial Harbor Craft Operating in California

[5]Tanker main engine emission factors from Tables II-6 & II-7 of CARB Emissions Estimation Methodology for Ocean-Going Vessels, May 2011

[6]Tanker auxiliary engine emission factors from Table II-8 of CARB Emissions Estimation Methodology for Ocean-Going Vessels, May 2011

[7]Tanker auxiliary boiler emission factors from Table II-9 of CARB Emissions Estimation Methodology for Ocean-Going Vessels, May 2011

[8]Emission factors for these pollutants were unavailable in the Commercial Harbor Craft CARB document so factors for a medium speed main tanker engine operating on 0.1% S MDO were used

[9]Emission factors from CARB Emissions Estimation Methodology for Commercial Harbor Craft Operating in California

[10]CO2 Emission factor from Assumptions for Estimating Greenhouse Gas Emissions from Commercial Harbor Craft Operating in California

[11]N2O and CH4 emission factors from Port of Long Beach Air Emissions Inventory - 2011

Assumptions:

114,000	DWT
2	Tugs @ 8 hours each
6	hour transit time (in/out)
20	hour hoteling time
4	hour maneuvering time (in/out)
	Boiler Operational During Hoteling Time

Table C-7: OGV and Tug Criteria Emissions							
Activity	**[1]Time in Activity (hrs)**	**CO**	**NOx**	**PM10**	**PM2.5**	**VOC**	**SOx**
Transit to/from MOT	6	45.52	546.20	15.72	14.48	26.90	86.07
Maneuvering	4	41.72	500.68	14.41	13.28	24.65	78.90
Hoteling	20	29.50	372.72	6.70	6.17	13.94	10.73
Boiler Unloading	20	3.65	38.35	14.61	14.24	2.01	301.33
Tug 1 (Tug Diesel)	8	32.90	48.77	1.76	2.50	6.00	13.68
Tug 2 (Tug Diesel)	8	32.90	48.77	1.76	2.50	6.00	13.68
	Total (lbs)	186.18	1,555.49	54.98	53.17	79.50	504.37
	Total (tons)	0.09	0.78	0.03	0.03	0.04	0.25
	Total (MT)						
	Number of Vessels						
Baseline (2005)	124	11.54	96.44	3.41	3.30	4.93	31.27
Lease Period	120	11.17	93.33	3.30	3.19	4.77	30.26
	Net Change (tons)	**-0.37**	**-3.11**	**-0.11**	**-0.11**	**-0.16**	**-1.01**
	Net Change (MT)						

[1]Time in activity assumed from project description

Table C-8: OGV and Tug GHG Emissions						
Activity	**Time in Activity**	**CO_2 Per OGV Trip (lbs)**	**CH_4 Per OGV Trip (lbs)**	**N_20 Per OGV Trip (lbs)**	**[1]Baseline (MTCO2e) (2005)**	**Anticipated Future (MTCO2e)**
Transit to/from MOT	6	26,689.14	0.4138	1.2827	1523.65	1474.50
Maneuvering	4	24,465.04	0.3793	1.1758	1396.68	1351.63
Hoteling (main diesel engine)	20	18,501.94	0.2145	0.8312	1055.18	1021.14
Hoteling Auxilary Fuel Oil	20	19,360.00	0.2145	0.8312	1103.46	1067.86
Boiler Unloading	20	17,714.36	0.0365	1.4610	1021.18	988.24
Tug 1 (Tug Diesel)	8	4,812.01	0.1184	0.2039	274.31	265.47
Tug 2 (Tug Diesel)	8	4,812.01	0.1184	0.2039	274.31	265.47
				Totals	6648.79	6434.31

Baseline # of Vessels	124
Future # of Vessels	120

[1]Assumes CH4 GWP = 25 N2O GWP = 298