Appendix E – Air Quality and Greenhouse Gas Calculations

E.1 Introduction

The following appendix details the methodology used to estimate air and greenhouse gas (GHG) emissions from the proposed Project and applies appropriate thresholds. This includes a discussion of the approach employed to estimate emissions from terrestrial construction equipment and vessels used during construction. Emissions analyzed include criteria pollutants of ozone precursors (reactive organic gases [ROGs] and nitrogen oxides [NOx]), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2); and GHG of carbon dioxide (CO_2), methane (CH4), and nitrous oxides (N_2O).

E.2 Terrestrial Construction Emissions Calculation Methodology

Emissions from Project terrestrial construction equipment were estimated using the CalEEMod Version 2020.4.0 emissions estimation model.[1] CalEEMod is approved by the California Air Pollution Control Officer's Association (CAPCOA) and recommended for use by the Bay Area Air Quality Management District (BAAQMD).

CalEEMod calculates emissions from construction activities associated with a project based on its size and land use classification, which for this Project was identified as "light industrial." Construction of the proposed Project requires both terrestrial (on land) and marine (in water) activities. Terrestrial activities include installing two high-density polyethylene conduits using horizontal directional drilling, pulling two fiber optic cables, and constructing two landing vaults. These activities would generate criteria pollutant and GHG emissions from off-road equipment (e.g., backhoes) and vehicles used for employee commuting and hauling. Fugitive dust and ROGs also would be generated by earthmoving activities. Marine activities include laying and burying the fiber optic cables. Vessels used to support these activities include vessel to move anchors, dive support vessels, and a crew transfer boat. Construction equipment usage was based on information provided by the Applicant with some CalEEMod defaults used for equipment horsepower. Assumptions regarding equipment used and level of use for both the western and eastern cable landing sites as well as marine equipment are provided in Table E-1.

[1] See http://www.aqmd.gov/caleemod/download-model

CalEEMod produces emissions estimates in terms of tons of criteria pollutant emissions per year. Daily emissions were obtained by dividing the annual emissions for a given activity by the number of days for that activity and converting to pounds.

Table E-1: Equipment Required for Construction Activities

Equipment	Hours/Day	Days	HP	Load Factor
Landing site preparation (western side)				
Delivery truck with boom	5	3	402	0.38
Install bore pipes using marine HDD (western side)				
Vermeer Navigator D330x500 Drill Rig (western side)	6	20	800	0.50
Vermeer High Pressure Mud Pump	6	20	350	0.74
Generator	8	20	84	0.74
Pit Pump	6	20	84	0.74
Excavator	2	20	158	0.38
Install BMH (western side)				
Excavator	8	3	158	0.38
small (20-50 ft) crane	2	3	231	0.29
Mixing Unit (Small portable)	8	3	9	0.56
Landing site preparation (eastern side)				
Delivery truck with boom	5	3	402	0.38
Install bore pipes using marine HDD (eastern side)				
Mini-HDD bore machine (eastern side)	6	10	221	0.5
Vermeer High Pressure Mud Pump	6	10	350	0.74
Generator	8	10	84	0.74
Pit Pump	6	10	84	0.74
Excavator	2	10	158	0.38
Install BMH (eastern side)				
Excavator	8	3	158	0.38
Small (20-50 ft) crane	2	3	231	0.29
Mixing Unit (Small portable)	8	3	9	0.56
Pre-lay grapnel run				
1920 Main HP Vessel (350 HP Auxiliary Engine)	12	2	1920	0.45/0.43

Equipment	Hours/Day	Days	HP	Load Factor
Marine cable lay and burial across SF Bay (jetting sled assisted) - Equipment on Barge				
Anchor Winches HPU Diesel (65 kW)	8	30	88	0.42
Anchor Winches HPU Diesel (65 kW)	8	30	88	0.42
Anchor Winches HPU Diesel (65 kW)	8	30	88	0.42
Anchor Winches HPU Diesel (65 kW)	8	30	88	0.42
Anchor Winches HPU Diesel (65 kW)	8	30	88	0.42
Anchor Winches HPU Diesel (65 kW)	8	30	88	0.42
20 kVA generator	12	30	27	0.74
20 kVA generator	12	30	27	0.74
Small (20-50 ft) crane knuckle boom	3	30	231	0.29
Water Pump	8	25	84	0.74
1920 HP Vessel to move anchors (350 HP Auxiliary Engine)	6	30	1920	0.45/0.43
1920 HP Vessel to move anchors (350 HP Auxiliary Engine)	6	30	1920	0.45/0.43
Dive Vessel 1920 Main HP Vessel (350 HP Auxiliary Engine)	3	30	1920	0.45/0.43
Crew Transfer Vessel 1920 Main HP Vessel (350 HP Auxiliary Engine)	3	30	1920	0.45/0.43
Landing site demobilization (western side)				
Delivery truck with boom	5	3	402	0.38
Excavator	1	3	158	0.38
Pulling Winch	6	3	172	0.42
Landing site demobilization (eastern side)				
Delivery truck with boom	5	3	402	0.38
Excavator	6	3	158	0.38
Pulling Winch	2	3	172	0.42
Post-lay inspection and burial				
1920 Main HP Vessel (350 HP Auxiliary Engine)	12	2	1920	0.45/0.43
Personnel travel				
HDD (10 people on-site) – Pick-up truck	1	15	250	0.38
Terrestrial (2 people on-site) – Pick-up truck	1	30	250	0.38
Marine (25 people on-site) – Pick-up truck	1	30	250	0.38

Terms:
ft = foot
HDD = horizontal directional drilling
HP = horsepower
kVA = kilovolt-amperes
kW = kilowatt
m^3 = cubic meters
Notes:
[a] Assumed default Load Factor for CalEEMod, which uses default OFFROAD2011 load factors

E.2.1 Off-Road Equipment

Emission factors for off-road construction equipment (e.g., cranes, pump, excavators) were obtained from the CalEEMod User's Guide appendix, which provides values per unit of activity (in grams per horsepower-hour). Pollutants were estimated by multiplying the CalEEMod emission factors by the equipment inventory shown in Table E-1. Model defaults were assumed for equipment horsepower and load factors, except for the drill rig used during terrestrial boring.

E.2.2 On-Road Equipment

On-road vehicles include vehicles used for employee commuting. Employees were assumed to commute 30 miles roundtrip to and from the site. Exhaust emissions from on-road vehicles were estimated using the EMFAC2017 emissions model. Emission factors for employee commute vehicles were based on a weighted average for all vehicle speeds for EMFAC's LDA/LDT vehicle categories. Offsite pick-up trucks required for crew movement were modeled using EMFAC's LDT and T6 Instate Heavy vehicle categories, respectively. Table E-1 summarizes the on-road vehicle inventory assumed in the emissions modeling. All on-road vehicles would be used for terrestrial construction (i.e., on land).

E.3 Vessel Emissions Calculation Methodology

E.3.1 Study Area

The air quality analysis considers the installation of the marine cable routes within Regulated California Waters (RCW), defined by the California Air Resources Board (CARB) as waters within 24 nautical miles (nm) of the California Baseline (i.e., the coastline and islands) (CARB 2016).

E.3.2 Marine Vessels

Marine vessels used during construction include pre-lay grapnel run vessels, support vessels to move anchors, dive vessels, and crew transfer vessels. Criteria pollutant emissions from marine vessels were quantified using USEPA's Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emission (USEPA 2022).

E.3.3 Load Factors

Load factors for the vessels were adjusted to appropriately represent auxiliary and propulsion engine power based on ship type and activity mode.

Vessel emissions were calculated using the following equation:

$$E = Power\ x\ Activity\ x\ LF\ X\ EF$$

Where:

- E = emissions, grams/year
- Power = rated power of the engine, kilowatt (kW) or horsepower (hp)
- Activity = activity, hours/year
- LF = load factor (ratio of average power used during normal operations as compared to maximum rated power), dimensionless
- EF = emission factor, grams of pollutant per unit of work, g/hp-hr or g/kW-hr

The various vessels were conservatively assumed to have 1920 HP main engines, and 350 HP auxiliary engines. The vessels will operate in two modes during construction. The first is "transit" back and forth to the construction site from the Port of Oakland. Transit occurs at 10 knots. The second is "maneuvering" during construction activities when the vessel is travelling at 5 knots around the worksite.

Emission factors for the vessels assuming that all engines were a combination of Category 2 and Category 3 medium-speed engines running on 0.1% sulfur marine gasoil/marine diesel oil, which has been required within California waters since 2014 and within the North American Emission Control Area (up to 23 200 nautical miles from the U.S. coastline) since 2015.

The load factor for the main engine was assumed to be 0.45 based on streamlined Port of Los Angeles and Port of Long Beach Harbor Craft load factors, and the load factor for the auxiliary engines were assumed to be 0.43 based on USEPA's NONROAD model (USEPA 2009).

E.3.4 Calculation of Criteria Pollutant Emissions

E.3.4.1 *Regional Significance Thresholds*

The BAAQMD California Environmental Quality Act (CEQA) guidance provides Regional Significance Thresholds for seven common criteria pollutants. The thresholds represent the maximum emissions from a project that are not expected to cause or contribute to an exceedance of the most stringent applicable federal or state ambient air quality standard. The BAAQMD significance thresholds for daily criteria air pollutant emissions for construction projects are listed below. The thresholds are average daily emissions. Thus, even if certain peak days have emissions over the identified thresholds, as long as the average daily emissions are below these thresholds, the impacts are considered less than significant. As the project is occurring for less than 1 year, annual average emissions do not need to be considered. The thresholds are summarized in Table E-2.

Table E-2: BAAQMD Regional Emissions Thresholds

Pollutant	Emissions Thresholds (pound per day) Construction
NOx	54
ROG	54
PM_{10} (exhaust)	82
$PM_{2.5}$ (exhaust)	54
SOx	None
CO	None

Source: BAAQMD 2017
Terms:
CO = carbon monoxide
NOx = nitrous oxides
$PM_{2.5}$ = particulate matter with a diameter of 2.5 microns or less (Fine)
PM_{10} = particulate matter with a diameter of 10 microns or less (Respirable)
ROG = Reactive Organic Gases
SOx = sulfur oxides

E.3.4.2 *Maximum Daily Emission Calculations*

Table E-3 summarizes the average daily emissions, accounting for the overlap of activities from both terrestrial and marine equipment. None of the criteria pollutants are above their respective BAAQMD thresholds.

Table E-3: Average Daily Project Criteria Pollutant Emissions

Pollutant	Average Emissions (pound per day) Construction
NOx	47.6
ROG	4.4
PM_{10} (exhaust)	1.5
$PM_{2.5}$ (exhaust)	1.5
SOx	2.0
CO	20.1

Terms:
CO = carbon monoxide
NOx = nitrous oxides
$PM_{2.5}$ = particulate matter with a diameter of 2.5 microns or less (Fine)
PM_{10} = particulate matter with a diameter of 10 microns or less (Respirable)
ROG = Reactive Organic Gases
SOx = sulfur oxides

E.4 Greenhouse Gas Emissions

Table E-4 details expected GHG emissions from the Project, by activity. According to the BAAQMD CEQA guidelines there is not a threshold of significance for construction-related GHG emissions; however, GHG emissions that would occur during construction should still be quantified and disclosed. The BAAQMD CEQA threshold of significance for GHG emissions from Project operations are compliance with the qualified GHG reduction strategy or 1,100 metric tons of CO_2e per year.

Table E-4: Annual Project GHG Emissions

Project Activity	CO_2e (metric tons per year)
Construction and Installation	266
Operational Emissions [a]	107

Notes:
[a] Operational emissions estimate represents one marine cable burial verification survey, undertaken 5 years after cable installation.

E.5 References

CARB (California Environmental Protection Agency Air Resources Board). 2016. Advisory to Owners or Operators of Ocean-Going Vessels Visiting California Ports: California Ocean-Going Vessel Fuel Regulation to Remain in Effect Subject to Reevaluation in Two Years. Accessed: March 8, 2017. Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2019-12/Marine%20Notice%202016-1_revADA.pdf

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