APPENDIX A1
ESSEX SAND & GRAVEL MINE
MINE AND RECLAMATION PLAN
MARCH 2025

AIR POLLUTANT EMISSIONS
ASSUMPTIONS AND CALCULATIONS

Table 1
Production Information

	Proposed Operations
MINING & PROCESSING	
Rock and Aggregate	400,000 tons/year (tpy)py
Days/year	300
Tons/day	13,333
Hours/day	8
Tons/day	1,375
Tons/hour	175
TRUCKING	
25-ton street legal haul trucks	400,000 tpy
Days/year	300
# of trucks/day	55
Miles/day (50 miles round trip)	2,750

Source: Skanska Mine and Reclamation Plan, 2024

Table 2
Essex Sand & Gravel Mine
Mobile Mine Equipment (Typical)

Equipment Type	Typical Number	Hours/day	Purpose
Dozer and/or grader	1	4	Excavate and loosen material. Access construction and maintenance.
Dump / Haul Trucks (on-site)	2	4 – 8	Transportation of material to plant and stockpiles as needed
Excavator	1	4 - 8	Excavate and load material into feeder and trucks.
Cat 988 Loader or equivalent	1 - 2	4 - 8	Excavate and load material into feeder and trucks.
Lubrication/fuel maintenance service truck	1	Once per week	Service truck for onsite equipment
Portable Processing Plant (feed hopper, crusher, screen(s), conveyors,	1	8	Crushing/screening plant as needed to process aggregate for road base and asphaltic concrete production.
Generator(s) (diesel) (800 KW typ.)	1	8	Supplies power to plants.
Water Truck (4,000 gallons typical)	1	4	Water for dust control on mining areas, haul roads, stockpiles and processing plant.

Source: Skanska 2024
Note that the equipment listed is typical and makes and models will vary.

Table 3
Essex Sand & Gravel Mine
Annual Mine Operations
Fugitive Dust Emissions (PM_{10} & $PM_{2.5}$)
Tons/Year (Controlled)

Source	Controlled Emission Factors: (PM_{10}) ($PM_{2.5}$)	Mining & Processing Emissions (tons/year)
	Lbs./Hour	
Dozing & Grading	3.1 (PM_{10}) 0.435 ($PM_{2.5}$)	1.86 0.26
	Lbs./Ton	
Loading[1]	0.0012 lbs/ton (PM_{10}) 0.00025 lbs./ton ($PM_{2.5}$)	
	Lbs./day/acre	
Active Mine & Plant Areas& Stockpiles[2]	1.186 lb/day/ac (PM_{10}) 0.247 lb/day/ac ($PM_{2.5}$)	0.71 0.15
Unpaved Roads[3] (onsite)	**Lbs./mile**	
On-Road 25-ton haul trucks	0.178 lbs/mile (PM_{10}) 0.037 lbs/mile ($PM_{2.5}$)	1.175 0.25
Totals	---	3.745 (PM_{10}) 0.66 ($PM_{2.5}$)

Source: Skanska & Lilburn Corporation 2025. See Appendix A for Excel tables.
Notes:

1. Loading includes three (3) operations, one loading haul trucks at mine and two loading operations at plant site (one load/drop at the processing plant feeder and one loading on-road trucks for transportation off-site). Assume 90% control based on water spraying material, washed material, dust suppressants, speed limits for trucking.
2. Active mine and plant areas/stockpiles at any one time: mine and plant 4 acres. Assume 80% control with water spraying; active 300 days/year.
3. Unpaved roads onsite include on and off-road haul truck movement to plant or directly off-site. Estimated controls 90% with watering, dust palliatives, gravel surface, and speed limits.

Assumptions

Silt content (s) = 5% (MDAQMD for sand & gravel plant road)
Silt content (s) = 8% (MDAQMD for sand & gravel processing) (Used 6.5%)
Moisture Content = 1.0% (water spray mining area during mining)

PM10 = 0.489 of Total Particulate Matter
PM2.5 = 0.208 of PM 10
Source: CEIDARS List SCAQMD 2006

FUGITIVE DUST EMISSIONS ESTIMATES

Dozing/Grading

Source of dozing equation below: AP-42, Section 11.9, Table 11.9.1 Bulldozing

Overburden Equation

$EF\ (PM10) = k * (s)^{1.5} / M^{1.4}$ lb/hr
$= 0.75 * 6.5^{1.5} / 1^{1.4}$ lb/hr
$= 0.75 * 16.57 / 1$
= 12.43 lbs./hr.

$EF\ (PM2.5) = k * (s)^{1.5} / M^{1.4}$ lb/hr
$= 0.105 * 6.5^{1.5} / 1^{1.4}$ lb/hr
$= 0.105 * 16.57 / 1$
= 1.74 lbs./hr.

k = 0.75 (PM10); = 0.105 for PM2.5 (AP-42 Section 11.9-1; Table 11.9-1)
Silt content (s) = 8% (MDAQMD)
Moisture content (M) = 1% (average)

Control factor = 75 % (water spraying)

EF (PM10) = 12.43 lbs./hr. x (100-75%) = 3.1 lbs./hr. (controlled) (Dozing/grading)
EF (PM2.5) = 1.74 lbs./hr x (100-75%) = 0.435 lbs/hr (controlled) (Dozing/grading)

Loading Trucks and Plant Feeder at Mine and Plant

Emissions from the loading/dropping activities at mine and plant sites include loading trucks and plant feeder.

Source: AP-42 Section 13.2.4 (EPA, November 2006)

EF (PM10) = k * (0.0032)* (U/5)^1.3 / (M/2)^1.4 lbs/ton

U (mean wind speed) = 12 mph (SCAQMD default factor)
Moisture content (M) = 0.5% (Dry; worst case per MDAQMD)
k (PM10) = 0.35

EF (PM10) = 0.35 * (0.0032) * (12/5^1.3 / (0.5/2)^1.4
= 0.00112 * 3.12/0.1436
= 0.024 lbs/ton (uncontrolled)

EF (PM10) with control = 90% (SCAQMD fugitive dust mitigation measures including limiting vehicle and equipment speeds to 15 mph, applying dust suppressants, water spraying active areas and roadways)

EF (PM10) with control = 0.024 * 0.1 = 0.0024 lbs/ton
EF (PM2.5) with control = 0.0024 * 0.208 = 0.0005 lbs/ton

Planned PM10 & PM2.5 Emissions:

Material loaded per day: 4,125 tons/day

- loaded onto trucks to feeder (1,375 tpd);
- loaded into process plant feeder (1,375 tpd); and
- processed material loaded into trucks for shipping 1,375 tpd).

EF(PM10) = 4,125 tpd * 0.0024 lbs/ton = 9.9 lbs/day x 300 days/year / 2000lbs/ton = 1.485 tons/year (PM10 controlled)

EF(PM2.5) = 1.485 tpy x 0.208 = 0.31 tpy (PM2.5 controlled)

Active Mining, Plant, and Stockpile Areas:

Planned Active Areas: **4 acres/day**
Mining – 2 acres
Plant/Stockpiles – 2 acres

Source: MDAQMD Mineral Guidance 2013 Section G

EF= J * 1.7 * sl / 1.5 * (365-P) / 235 * I / 15 lb./day/ac

J = 0.5 for PM_{10}
J = 0.2 for $PM_{2.5}$
Silt loading (sl) = 8.0% for sand & gravel processing
P = ave. days of precipitation (default = 20 days) MDAQMD
I = windy hours greater than 12 mph = 13.3% (MDAQMD default)

For Active Mine Areas, Stockpiles, and Crusher Area

EF(PM10) = 0.5 * 1.7 * 8/1.5 * 1.47 * 0.89 = 5.93 lbs/day/ac (uncontrolled)

EF(PM10) at 80% control with water spraying = 1.186 lbs./day/ac (controlled)

EF(PM2.5) = 0.247 lbs./day/ac (controlled)

Onsite Haul Road Dust

Table 4
Essex Sand & Gravel Mine
On-Site Haul Road Dust
Haul Trucks

Parameters	Proposed
25-ton on-road haul trucks	
Truck Weight (tons): Empty: 15 tons Full: 40 tons Average: 27.5 tons	
Aggregate Production	400,000 tons/year
Aggregate Trips/Day	55 - mine to feeder 55 - plant to paved road
Days/Year	300
Vehicle miles traveled (VMT) (round trip)	0.4
Miles/Year	13,200
Control Factor	90%

Emission Factor (PM_{10}) = K * $(s/12)^a$ * $(W/3)^b$

Source: AP-42, Section 13.2.2, Unpaved Roads (11-2006 & SCAQMD)

K = 1.5 for PM_{10} (lbs/VMT)
s (silt content) = 4.8% (from sand & gravel road; AP-42 and MDAQMD)
W (ave. truck wt.) = 27.5 tons for 25-ton trucks
a = 0.9; b = 0.45

EF (PM_{10}) = 1.5 * $(4.8/12)^{0.9}$ * $(27.5/3)^{0.45}$ lbs/VMT
= 1.5 * 0.438 * 2.71 = **1.78 lbs./VMT (uncontrolled for 25-ton trucks)**

Dust Control Estimates

Water spray – 61% (SCAQMD); 15 mph speed limit – 57% (SCAQMD)
Use of approved dust suppressant on unpaved roads and work areas – 84% (SCAQMD)
Gravel bed on plant roads. Used 90% for unpaved roads and areas.

Table A1
Esex Sand & Gravel Mine
Operational Emissions (Typical Mobile Equipment)

Operation	Emission Factor	Units	Equation Variables 1	Equation Variables 2	Emissions PM-10 lbs/day	Emissions PM-2.5 lbs/day	Emissions ROG lbs/day	Emissions CO lbs/day	Emissions NOX lbs/day	Emissions SOX lbs/day
Excavation Equipment Exhaust Emissions			Pieces of Equipment	Operating Hours						
PM-10										
PM-2.5 Cat 988 Loader (typ)	0.012	lbs/hr	1	8	0.10	0.02				
Dozer	0.023	lbs/hr	1	8	0.18	0.04				
Generator Set (800kW)	0.008	lbs/hr	2	8	0.13	0.03				
Dump/Haul Trucks	0.014	lbs/hr	2	8	0.23	0.05				
Other Material Handling Equipment	0.012	lbs/hr	1	8	0.10	0.02				
Water Truck (4000 gal)	0.014	lbs/hr	1	8	0.11	0.02				
ROG										
Cat 988 Loader	0.056	lbs/hr	1	8			0.45			
Dozer	0.079	lbs/hr	1	8			0.63			
Generator Set (800kW)	0.029	lbs/hr	1	8			0.23			
Dump/Haul Trucks	0.114	lbs/hr	2	8			1.82			
Other Material Handling Equipment	0.070	lbs/hr	1	4			0.28			
Water Truck (4000 gal)	0.114	lbs/hr	1	4			0.46			
CO										
Cat 988 Loader	0.431	lbs/hr	1	8				3.45		
Dozer	0.507	lbs/hr	1	8				4.05		
Generator Set (800kW)	0.267	lbs/hr	1	8				2.13		
Dump/Haul Trucks	0.539	lbs/hr	2	8				8.62		
Other Material Handling Equipment	0.436	lbs/hr	1	4				1.74		
Water Truck (4000 gal)	0.539	lbs/hr	1	4				2.15		
NOX										
Cat 988 Loader	0.284	lbs/hr	1	8					2.27	
Dozer	0.449	lbs/hr	1	8					3.59	
Generator Set (800kW)	0.233	lbs/hr	1	8					1.86	
Dump/Haul Trucks	0.477	lbs/hr	2	8					7.63	
Other Material Handling Equipment	0.384	lbs/hr	1	4					1.54	
Water Truck (4000 gal)	0.477	lbs/hr	1	4					1.91	
SOX										
Cat 988 Loader	0.001	lbs/hr	1	8						0.01
Dozer	0.001	lbs/hr	1	8						0.01
Generator Set (800kW)	0.001	lbs/hr	1	8						0.01
Dump/Haul Trucks	0.003	lbs/hr	2	8						0.04
Other Material Handling Equipment	0.002	lbs/hr	1	4						0.01
Water Truck (4000 gal)	0.003	lbs/hr	1	4						0.01
				Total	0.85	0.18	3.87	22.15	18.80	0.08
			Tons/Year based on 300 days/year		0.13	0.03	0.580	3.322	2.820	0.012

Sources: Off-Road Mobile Source Emission Factors; SCAQMD 2025 (composite)
Mobile Equipment typical with composite emission factors.
Based on 400,000 tons/year operating 300 days/year

Table A2
Essex Sand & Gravel Mine
Stationary Source Emissions from Portable Crushing/Screening Plant (typical)

Operation		Emission Factor	Units	Equation Variables 1	2	3	Emissions PM-10 lbs/day	Particulate Control Efficiency	PM-10 lbs/day with control	PM-2.5 lbs/day with control	CO lbs/day	NOX lbs/day	SOX lbs/day
Aggregate Processing Plant (typical)				Tons/hr	Operating Hours			included					
PM10											NA	NA	NA
	Feeder	0.00054	lbs/ton	175	8	----	0.76		0.76	0.16			
	Crusher	0.00054	lbs/ton	175	8	----	0.76		0.76	0.16			
	Screen 1	0.00074	lbs/ton	125	8	----	0.74		0.74	0.15			
	Screen 2	0.00074	lbs/ton	125	8	----	0.74		0.74	0.15			
	Conveyor 1	0.00074	lbs/ton	125	8	----	0.74		0.74	0.15			
	Conveyor 2	0.00074	lbs/ton	125	8	----	0.74		0.74	0.15			
	Conveyoer 3	0.00074	lbs/ton	90	8	----	0.53		0.53	0.11			
	Conveyor 4	0.00074	lbs/ton	90	8	----	0.53		0.53	0.11			
	Conveyor 5	0.00074	lbs/ton	45	8	----	0.27		0.27	0.06			
	Conveyor 6	0.00074	lbs/ton	45	8	----	0.27		0.27	0.06			

						Daily total (lbs)	6.07	----	6.07	1.26	----	----	----
						Total Annual (tons) Planned 300 days/yr	0.91	----	0.91	0.19	0.0	0.0	0.0

Notes: Portable Crushing/Screening plant based on up to 8 hrs/day at 1375 tpd; 300 days/year.
Portable crushing/screening plant requires MDAQMD Permit to Construct/Operate
Sources: AP-42, SCAQMD
AP-42, Section 11.19 - Crushed Stone Processing and Sand and Gravel Processing: EPA August 2004
Diesel generators included in Table A1.
Dust related PM2.5 = 0.208 of PM10 (CEIDARS List).
Particulate Control Efficiencies are included in Emission Factors.
Crusher and screens include water sprays.
Portable plant is typical with typical throughputs that vary with demand and material quality.

Table A3
Essex Sand & Gravel Mine
Truck Movement Dust Emissions On-Site

			Equation Variables		Emissions		
Operation	**Emission Factor**	**Units**	**1**	**2**	**PM-10** lbs/day Unmitigated	**PM-10** lbs/day Mitigated	**PM-2.5** lbs/day Mitigated
Truck Travel Onsite			# of trips/day	vmt			
25-ton Haul Trucks	1.78	lbs/vmt	110	0.40	78.3	7.8	0.4
		lbs/vmt			0.0	0.0	0.0
					0.0	0.0	0.0
				Total	78.3	7.8	1.6
			Total Annual tons/year		11.75	1.17	0.24

Note: PM10 mitigation assumed to reduce emissions 80 percent on roads per AP-42 and SCAQMD.
Includes watering, , dust suppressants, gravel surface, and speed limits.

vmt = vehicle miles driven
Source of Emission Factor: SCAQMD Particulate Matter Emission Factors
and AP-42, Chapter 13.2.2

$E=k * (s/12)^{0.9} * (W/3)^{0.45}$

E = PM10 emissions/vmt
k = constant (for PM10 = 1.5)
S - silt content (for sand & gravel plant road = 4.8%)
W = mean vehicle weight (street legal haul truck is 15 tons empty and 25 tons loaded) (Mean wt. = 17.5 tons)

Dust related PM2.5 = 0.208 of PM10 (CEIDARS List).
Approx. 55 25-ton trucks/day from mine to feeder and 55 -25-ton trucks/day from plant to road.
Ave. round trip distance from middle of mine to feeder 1,000 feet and distance from road to plant stockpiles.
Note in pit trucking may not occur as material may be directly loaded by loader into feeder.

Table A4
Essex Sand & Gravel Mine
On-Road Haul Truck & Vehicle Exhaust Emissions Off-Site

Operation		Emission Factor	Units	Equation Variables 1	Equation Variables 2	Emissions PM-10 lbs/day	PM-2.5 lbs/day	ROC lbs/day	CO lbs/day	NOX lbs/day	SOX lbs/day	CO2 lbs/day	CH4 lbs/day
Vehicle Emissions Off-site				# of trips per day	vmt						Negl		
PM-10	Haul Trucks	0.0010	lbs/mile	55	50	2.663	2.450						
PM-2.5	Employee trips	0.0001	lbs/mile	8	65	0.050	0.046						
	Fuel Delivery Truck	0.0010	lbs/mile	1	65	0.063	0.058						
ROG	Haul Trucks	0.0010	lbs/mile	55	50			2.6					
	Employee trips	0.0005	lbs/mile	8	65			0.25					
	Fuel Delivery Truck	0.0010	lbs/mile	1	65			0.06					
CO	Haul Trucks	0.0048	lbs/mile	55	50				13.17				
	Employee trips	0.0040	lbs/mile	8	65				2.07				
	Fuel Delivery Truck	0.0048	lbs/mile	1	65				0.31				
NOX	Haul Trucks	0.0110	lbs/mile	55	50					30.22			
	Employee trips	0.0004	lbs/mile	8	65					0.18			
	Fuel Delivery Truck	0.0110	lbs/mile	1	65					0.71			
CO2	Haul Trucks	3.6300	lbs/mile	55	50							9,983	
	Employee trips	1.1100	lbs/mile	8	65							577	
	Fuel Delivery Truck	2.8800	lbs/mile	1	65							187	
CH4	Haul Trucks	0.00000	lbs/mile	55	50								0.00
	Employee trips	0.00003	lbs/mile	8	65								0.02
	Fuel Delivery Truck	0.00004	lbs/mile	1	65								0.00
													0.00
					Total	2.78	2.55	2.96	15.55	31.11	Negl	10,747	0.0210
				Total Tons/Year (2025)		0.42	0.38	0.44	2.33	4.67	Negl	1,465	0.08
												mtCO2e	mtCO2e

Emission Factors Source: SCAQMD On-Road Heavy Heavy Duty Diesel Trucks and On-Road Passenger Vehicles & Delivery Truck
Scenario Year 2025
PM2.5 fraction of PM10 Exhaust is 0.92 (CEIDARS List)
vmt = miles driven off-site

55 haul truck round trip averge/day for 300 days/year; 50 miles per round-way trip (average) to work sites.
Diesel fuel and other deliveies would occur once per day from Needles.
Annual CO2 and CH4 in metric tons CO2 equivalent (mtCO2e)
Employee vehicles est at 8 round trips per day at an average distance of 65 miles (Needles)

Table A5
Essex Sand & Gravel Mine
GHG Emissions

Operation	Emission Factor	Units	Equation Variables 1	Equation Variables 2	GHG Emissions CO2 lbs/day	GHG Emissions CH4 lbs/day	GHG Emissions N2O g/day
Excavation Equipment Exhaust Emissions			Pieces of Equipment	Operating Hours			
CO2							
Cat 988 Loader	109.0	lbs/hr	1	8	872.0		
Dozer	114.0	lbs/hr	1	8	912.0		
Generator Set (800kW)	337.0	lbs/hr	1	8	2696.0		
Dump/Haul Trucks	260.0	lbs/hr	2	8	4160.0		
Other Material Handling Equipment	141.0	lbs/hr	1	8	1128.0		
Water Truck (4000 gal)	260.0	lbs/hr	1	4	1040.0		
CH4							
Cat 988 Loader	0.005	lbs/hr	1	8		0.0	
Dozer	0.007	lbs/hr	1	8		0.1	
Generator Set (800kW)	0.008	lbs/hr	1	8		0.1	
Dump/Haul Trucks	0.010	lbs/hr	2	8		0.2	
Other Material Handling Equipment	0.007	lbs/hr	1	8		0.1	
Water Truck (4000 gal)	0.010	lbs/hr	1	4		0.0	
N2O* *Negligible*							
Cat 988 Loader	0.080	g/mile	1	8			0.6
Dozer	0.520	g/mile	1	8			4.2
Generator Set (800kW)	0.050	g/mile	1	8			0.4
Dump/Haul Trucks	0.246	g/mile	2	8			3.9
Other Material Handling Equipment	0.246	g/mile	1	8			2.0
Water Truck (4000 gal)	0.246	g/mile	1	4			1.0
				g per day	0.00	0.00	12.09
				Total lbs/day	10,808.00	0.42	0.02
				Total MTCO2e/day	4.91	0.01	0.00
				MTCO2e/Year	1,473.82	1.61	0.87
				Total MTCO2e/year	**1476.30**		

CO2 GWP	1
CH4 GWP	28
N2O GWP	265

Sources: Off-Road Mobile Source Emission Factors; SCAQMD 2025
Source N2O: California Climate Action Registry General Reporting Protocol, 2009I;
Table A9-8-C SCAQMD Handbook; Climate Leaders EPA, Section 3, Table 2
Duration
(days): 300