Appendix C

Air Quality Modeling Results/ Greenhouse Gas Modeling Results

Air Quality and Greenhouse Gas Emissions Quantification: Methodology and Calculations

Project: Solano 4 Wind

For the Solano 4 Wind project Environmental Impact Report (EIR), air pollutant and greenhouse gas (GHG) emissions from construction activities were estimated using the Sacramento Metropolitan Air Quality Management District (SMAQMD) Roadway Construction Emissions Model (Version 9.0). Minimal off-model calculations were possible without an accurate assessment of construction details. Using a typical equipment list of off-road heavy-duty equipment required for this type of project and information provided by the project applicant, reasonable assumptions were made to modify the Roadway Construction Emissions Model default values. Activities proposed for construction that would result in air emissions and assumptions used to complete the modeling are outlined in the table below.

		Construction Phase	Construction Period	Construction Workers Per Day	Standard Off-Road Heavy-Duty Equipment Required
	1	**Demolition Phase**	5 months	20	
		Modeling Notes	4/1/21 - 9/1/21		Backhoe
-		Phase I includes 16 units			Grader
		Assume 100 foot radius each unit			Dozer
		Disturbed Area = 800 square feet per unit			Loader/Skid Steer
*		16 x 800 = 12,800 ft2 = 0.3 acres			Dump Truck
					Scraper
-		138 hauling trips = 1 trip/day			Water Truck
		estimated as soil hauling			Pickup Truck
					20HP Gen Set
-		crane is 2 month activity under Grading/Ex			Rough Terrain Forklift
					Roller
					Crane
	2	**Road Construction**	9 months	25	
		Modeling Notes	4/15/21 - 1/15/22		Backhoe
-		5.5 miles new road			Grader
-		0.6 mile connector road			Dozer
-		3 miles existing roads to be improved			Loader/Skid Steer
*		9.1 miles roadway total			Dump Truck
*		33.1 acres total			Scraper
					Water Truck
					Pickup Truck
					Compactor
					Roller
					Rough Terrain Forklift
					20HP Gen set
					20 Ton Haul Truck (Gravel)
	3	**Home Run Collection Construction**	6 months	10	
		Modeling Notes	7/15/21 - 12/15/21		Trenchers
		18 miles total			Dozer
		43.6 acres total			Backhoe
					Rough Terrain Forklift
					Pickup Truck
					20HP Gen Set
					Semi-trailer Truck
	4	**Foundation Construction**	9 months	25	
		Modeling Notes	5/7/21 - 2/7/22		Backhoe
-		Foundation construction area			Grader
		Assumes 200 ft radius for each WTG and tower			Dozer
		22 WTG + 2 meteorological tower			Loader/skid steer
*		Total area = 69 acres			Dump Truck
		Distance = 1.8 miles			Rock Trucks
					Water Truck
					Crane
					Pickup Truck
					Compactor
					Roller
					Semi-trailer Trucks
					Rough terrain forklift
					20HP Gen Set
					Concrete and pump truck
					Cement mixer
	5	**WTG Delivery, Erection**	4 months	70	
		Modeling Notes	8/2/22 - 12/2/22		Intermediate Crane
-		Heavy crane is only 80 days			Heavy Crane
		activity under Grading			Pickup Truck
					Rough Terrain Forklift
					20HP Gen Set
-		18 Semi-trailer truck 560 hp per WTG, 396 trips			Cement Mixers
		approx. 40 miles one way calcs off-model			

Notes: General Equipment and Phasing provided by SMUD

Equipment list and construction workers adjusted to reflect a maximum of approximately 70 employees on-site during overlapping phases

Due to overlapping phases, the use of various heavy-duty construction equipment from various phases could be occurring simultaneously. The analysis identifies the worst-case-scenario for construction emissions during overlapping phases.

The maximum pounds per day in row 11 is summed over overlapping phases, but the maximum tons per phase in row 34 is not summed over overlapping phases.

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> Solano 4 Demolition

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	4.62	32.59	47.59	5.14	2.14	3.00	2.55	1.92	0.62	0.08	7,539.49	2.11	0.12	7,627.97
Grading/Excavation	0.86	4.55	10.06	3.42	0.42	3.00	1.00	0.38	0.62	0.01	1,425.82	0.37	0.04	1,446.58
Drainage/Utilities/Sub-Grade	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
Paving	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
Maximum (pounds/day)	5.49	37.14	57.65	8.56	2.56	6.00	3.55	2.30	1.25	0.09	8,965.30	2.47	0.16	9,074.56
Total (tons/construction project)	0.27	1.89	2.84	0.36	0.13	0.23	0.16	0.11	0.05	0.00	446.04	0.12	0.01	451.36

Notes:

Project Start Year ->	2021
Project Length (months) ->	5
Total Project Area (acres) ->	0
Maximum Area Disturbed/Day (acres) ->	0
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	30	0	800	40
Grading/Excavation	0	0	0	0	200	40
Drainage/Utilities/Sub-Grade	0	0	0	0	0	40
Paving	0	0	0	0	0	40

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Solano 4 Demolition

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.25	1.79	2.62	0.28	0.12	0.17	0.14	0.11	0.03	0.00	414.67	0.12	0.01	380.60
Grading/Excavation	0.02	0.10	0.22	0.08	0.01	0.07	0.02	0.01	0.01	0.00	31.37	0.01	0.00	28.87
Drainage/Utilities/Sub-Grade	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
Paving	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
Maximum (tons/phase)	0.25	1.79	2.62	0.28	0.12	0.17	0.14	0.11	0.03	0.00	414.67	0.12	0.01	380.60
Total (tons/construction project)	0.27	1.89	2.84	0.36	0.13	0.23	0.16	0.11	0.05	0.00	446.04	0.12	0.01	409.47

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> Solano 4 Road Construction

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	1.26	11.74	11.38	30.59	0.59	30.00	6.75	0.51	6.24	0.03	2,701.56	0.72	0.05	2,735.70
Grading/Excavation	4.36	32.66	47.48	32.16	2.16	30.00	8.17	1.93	6.24	0.07	6,675.91	1.88	0.10	6,752.21
Drainage/Utilities/Sub-Grade	4.06	33.11	46.82	32.00	2.00	30.00	7.96	1.72	6.24	0.10	10,240.82	1.58	0.66	10,478.20
Paving	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
Maximum (pounds/day)	4.36	33.11	47.48	32.16	2.16	30.00	8.17	1.93	6.24	0.10	10,240.82	1.88	0.66	10,478.20
Total (tons/construction project)	0.38	2.97	4.20	3.16	0.19	2.97	0.78	0.17	0.62	0.01	731.98	0.16	0.03	744.56

Notes:

Project Start Year ->	2021
Project Length (months) ->	9
Total Project Area (acres) ->	33
Maximum Area Disturbed/Day (acres) ->	3
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	0	0	480	40
Grading/Excavation	0	0	0	0	1,000	40
Drainage/Utilities/Sub-Grade	603	0	930	0	800	40
Paving	0	0	0	0	0	40

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Solano 4 Road Construction

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.02	0.16	0.15	0.40	0.01	0.40	0.09	0.01	0.08	0.00	35.66	0.01	0.00	32.76
Grading/Excavation	0.22	1.67	2.43	1.64	0.11	1.53	0.42	0.10	0.32	0.00	341.47	0.10	0.01	313.32
Drainage/Utilities/Sub-Grade	0.14	1.15	1.62	1.11	0.07	1.04	0.28	0.06	0.22	0.00	354.84	0.05	0.02	329.37
Paving	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
Maximum (tons/phase)	0.22	1.67	2.43	1.64	0.11	1.53	0.42	0.10	0.32	0.00	354.84	0.10	0.02	329.37
Total (tons/construction project)	0.38	2.97	4.20	3.16	0.19	2.97	0.78	0.17	0.62	0.01	731.98	0.16	0.03	675.46

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> Solano 4 Home Run Collection

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	1.31	7.44	13.28	40.70	0.70	40.00	8.93	0.61	8.32	0.02	1,588.02	0.37	0.04	1,610.27
Grading/Excavation	2.42	15.94	23.66	41.21	1.21	40.00	9.40	1.08	8.32	0.04	3,527.24	1.00	0.06	3,570.37
Drainage/Utilities/Sub-Grade	2.62	16.84	23.61	41.13	1.13	40.00	9.35	1.03	8.32	0.04	3,869.44	0.95	0.06	3,912.02
Paving	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
Maximum (pounds/day)	2.62	16.84	23.66	41.21	1.21	40.00	9.40	1.08	8.32	0.04	3,869.44	1.00	0.06	3,912.02
Total (tons/construction project)	0.15	0.99	1.46	2.71	0.07	2.64	0.61	0.07	0.55	0.00	221.50	0.06	0.00	224.13

Notes:

Project Start Year ->	2021
Project Length (months) ->	6
Total Project Area (acres) ->	44
Maximum Area Disturbed/Day (acres) ->	4
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	0	0	400	40
Grading/Excavation	0	0	0	0	400	40
Drainage/Utilities/Sub-Grade	0	0	0	0	400	40
Paving	0	0	0	0	2,160	40

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Solano 4 Home Run Collection

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.01	0.07	0.13	0.40	0.01	0.40	0.09	0.01	0.08	0.00	15.72	0.00	0.00	14.46
Grading/Excavation	0.08	0.53	0.78	1.36	0.04	1.32	0.31	0.04	0.27	0.00	116.40	0.03	0.00	106.89
Drainage/Utilities/Sub-Grade	0.06	0.39	0.55	0.95	0.03	0.92	0.22	0.02	0.19	0.00	89.38	0.02	0.00	81.98
Paving	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
Maximum (tons/phase)	0.08	0.53	0.78	1.36	0.04	1.32	0.31	0.04	0.27	0.00	116.40	0.03	0.00	106.89
Total (tons/construction project)	0.15	0.99	1.46	2.71	0.07	2.64	0.61	0.07	0.55	0.00	221.50	0.06	0.00	203.33

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> Solano 4 Foundation

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	2.35	11.47	24.25	21.23	1.23	20.00	5.26	1.10	4.16	0.02	2,415.37	0.64	0.05	2,446.53
Grading/Excavation	5.61	29.41	61.91	22.64	2.64	20.00	6.53	2.37	4.16	0.08	7,844.79	2.26	0.11	7,933.67
Drainage/Utilities/Sub-Grade	4.20	30.42	39.31	21.91	1.91	20.00	5.88	1.72	4.16	0.07	6,918.17	1.83	0.10	6,993.68
Paving	1.77	17.65	15.31	0.82	0.82	0.00	0.75	0.75	0.00	0.03	3,148.50	0.57	0.07	3,184.67
Maximum (pounds/day)	5.61	30.42	61.91	22.64	2.64	20.00	6.53	2.37	4.16	0.08	7,844.79	2.26	0.11	7,933.67
Total (tons/construction project)	0.42	2.59	4.39	1.88	0.20	1.68	0.53	0.18	0.35	0.01	625.62	0.17	0.01	632.67

Notes:

Project Start Year ->	2021
Project Length (months) ->	9
Total Project Area (acres) ->	69
Maximum Area Disturbed/Day (acres) ->	2
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	0	0	400	40
Grading/Excavation	0	0	0	0	1,000	40
Drainage/Utilities/Sub-Grade	0	0	0	0	1,000	40
Paving	0	0	0	30	480	40

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Solano 4 Foundation

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.02	0.11	0.24	0.21	0.01	0.20	0.05	0.01	0.04	0.00	23.91	0.01	0.00	21.97
Grading/Excavation	0.25	1.31	2.76	1.01	0.12	0.89	0.29	0.11	0.19	0.00	349.49	0.10	0.00	320.64
Drainage/Utilities/Sub-Grade	0.12	0.90	1.17	0.65	0.06	0.59	0.17	0.05	0.12	0.00	205.47	0.05	0.00	188.44
Paving	0.03	0.26	0.23	0.01	0.01	0.00	0.01	0.01	0.00	0.00	46.76	0.01	0.00	42.90
Maximum (tons/phase)	0.25	1.31	2.76	1.01	0.12	0.89	0.29	0.11	0.19	0.00	349.49	0.10	0.00	320.64
Total (tons/construction project)	0.42	2.59	4.39	1.88	0.20	1.68	0.53	0.18	0.35	0.01	625.62	0.17	0.01	573.95

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

The maximum pounds per day in row 11 is summed over overlapping phases, but the maximum tons per phase in row 34 is not summed over overlapping phases.

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> Solano 4 Demolition

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	1.24	12.48	8.18	6.59	0.59	6.00	1.65	0.40	1.25	0.03	3,192.91	0.37	0.06	3,221.30
Grading/Excavation	0.37	1.89	4.18	6.17	0.17	6.00	1.41	0.16	1.25	0.01	558.83	0.18	0.01	564.85
Drainage/Utilities/Sub-Grade	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
Paving	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
Maximum (pounds/day)	1.61	14.38	12.37	12.76	0.76	12.00	3.06	0.56	2.50	0.04	3,751.74	0.55	0.07	3,786.16
Total (tons/construction project)	0.07	0.60	0.48	0.47	0.03	0.44	0.11	0.02	0.09	0.00	156.47	0.02	0.00	157.89

Notes:

Project Start Year ->	2022
Project Length (months) ->	4
Total Project Area (acres) ->	0
Maximum Area Disturbed/Day (acres) ->	0
Water Truck Used? ->	No

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	0	0	2,800	0
Grading/Excavation	0	0	0	0	0	0
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0
Paving	0	0	0	0	0	0

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Solano 4 Demolition

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.05	0.55	0.36	0.29	0.03	0.26	0.07	0.02	0.05	0.00	140.49	0.02	0.00	128.58
Grading/Excavation	0.01	0.05	0.12	0.18	0.00	0.17	0.04	0.00	0.04	0.00	15.98	0.01	0.00	14.66
Drainage/Utilities/Sub-Grade	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
Paving	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
Maximum (tons/phase)	0.05	0.55	0.36	0.29	0.03	0.26	0.07	0.02	0.05	0.00	140.49	0.02	0.00	128.58
Total (tons/construction project)	0.07	0.60	0.48	0.47	0.03	0.44	0.11	0.02	0.09	0.00	156.47	0.02	0.00	143.24

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

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

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Overlapping Phases of Construction

Construction Month	Phase 1	Phase 2	Phase 3	Phase 4
Apr-21	x	x		
May-21	x	x		x
Jun-21	x	x		x
Jul-21	x	x	x	x
Aug-21	x	x	x	x
Sep-21		x	x	x
Oct-21		x	x	x
Nov-21		x	x	x
Dec-21		x	x	x
Jan-22		x		x

Basic Conversions	Factor	Value	Units
	1 pound equals	453.592	grams
	1 MT equals	1.102	tons
	Total # of days in a week	7	days
	1 kg equals	1,000	grams
	1 Year equals	365	days
	1 ton equals	2,000	pounds
	Global Warming Potential of CH4	25	N/A
	Global Warming Potential of N2O	298	N/A

Source: SMAQMD Road Construction Emissions Model. V.9.0

Gravel Assumptions for Phase 2 Roads

length (ft)	width	depth	area (ft3)	cubic yards	truck trips	days	truck trips/day	cubic yards/day
48,048	16	2	1,537,536	56,946	2,847	95	30	603

9.1 miles = 48,048 feet

WTG Delivery Trips Emissions

Tractor Emissions Factor

2022		g/hp/hr	g/hp/hr	g/hp/hr	g/hp/hr	g/hp/hr	g/hp/hr	g/hp/hr	g/hp/hr	g/hp/hr
Equipment	**MaxHP**	ROG	CO	NOX	SOX	PM10	PM2.5	CO2	CH4	N2O
Tractors/Loaders/ Backhoes	500	0.160	1.280	1.437	0.005	0.053	0.049	469.256	0.152	0.004

Source: SMAQMD Road Construction Emissions Model. V.9.0

Equipment	No. trips per WTG	Hours/ round trip	Equip Hrs/ WTG	WTG	Travel Hrs
Trailer truck	18	6	108	22	2,376

Assumes approximately 3 hours for each one way delivery

Estimated Emissions

	Total Hrs Used	Equip Hrs/ WTG	Hours Equip Use/ day	ROG (lbs/day)	CO (lbs/day)	NOX (lbs/day)	SOX (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (metric tons/yr)
Trailer truck	2,376	108	30	5.30	42.337	47.519	0.159	1.749	1.610	15,518.01	5.020	0.141	2,597.66

Assumes 5 trailer truck deliveries per day.

WTG Delivery and Erection Emissions

	ROG (lbs/day)	CO (lbs/day)	NOX (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOX (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (metric tons/yr)
WTG RoadMod	1.61	14.38	12.37	12.76	0.76	12.00	3.06	0.56	2.50	0.04	3,751.74	0.55	0.07	143.24
Trailer truck	5.30	42.337	47.519	1.749			1.610			0.159	15,518.01	5.020	0.141	2,597.66
Total	6.91	56.72	59.89	14.51	0.76	12.00	4.67	0.56	2.50	0.20	19,269.75	5.57	0.21	2,740.90

Criteria Air Pollutant Emission Rates for Electricity from Various Sources

eGrid Subregion	eGrid Subregion Name	eGRID Subregion Average Output Emission Rates (lb/MWh)					
		CO2	CH4	N2O	CO2e	NOX	SO2
CAMX	WECC California	528	0.033	0.004	530	0.567	0.052

Source: eGRID206 Version 8.0. June 14, 2018. Created 3/7/2019

Avoided PM2.5 Rate	
Region	lb/MWh
California	0.04

Source: 2017 AVERT Emission Factors, June 2018. EPA

TABLE A9 - 11 - B

EMISSION FACTORS (H) FOR EACH CRITERIA POLLUTANT FROM CONSUMPTION OF ELECTRICITY
(Pounds Per Megawatt-Hours)

Pollutant Type	CO	ROC	NOx	SOx	PM10
	0.20	0.01	1.15	0.12	0.04

Source: SCAQMD Air Quality Handbook, 1993.

Hourly Average Emissions Summary for Electricity Use for PM10
lbs/MWh
0.0627

Source: Reference Appendices for the 2008 Building Energy Efficiency Standards for Residential and Nonresidential Builings. CEC. Table 3-4.

Energy Production from Solano 4 Wind Project

Installed Capacity		Net Energy per Year			Daily Energy Production	
MW	MWh (annual)	GWh	MWh	kWh	MWh	kWh
92.4	809,424	290.80	290,800	290,800,000	796.7	796,712.33

Proposed Project = 92.4 MW
1 GW=1,000 MW=1,000,000 kW
1 MW × 365 days x 24 hours = 8,760 MWh annually

Source: 2017 AVERT Emission Factors, June 2018. EPA. Black & Veatch January 2018: Solano Wind Energy Project, Wind Project Expansion Assessment

Table 4-4 Vestas V136-4.20 P50 Annual Energy and Net Capacity Factor

Phase	Make	Model	#WTGs	Capacity (MW)	Wake Loss	Net Energy (GWh)	Capacity Factor
Phase 1	Vestas	V136-4.20	6	25.2	11.2%	81.7	37.0%
Phase 1 Addn.	Vestas	V136-4.20	4	16.8	12.1%	52.2	35.5%
Phase 4	Vestas	V136-4.20	12	50.4	9.7%	156.9	35.5%
Total			**22**	**92.4**	**10.6%**	**290.8**	**35.9%**

Source: Solano Wind Energy Project, Wind Project Expansion Assessment. Black & Veatch, January 4, 2018.

SMUD Total Avoided Emissions from Project Implementation

	SMUD Criteria Air Pollutant Emissions Rates lb/MWh										
	ROG	CO	SOX	CO2	CH4	N2O	CO2e	NOX	SO2	PM2.5	PM10
	0.01	0.2	0.12	528	0.033	0.004	530	0.567	0.052	0.04	0.0627
	Total (lbs)										
	ROG	CO	SOX	CO2	CH4	N2O	CO2e	NOX	SO2	PM2.5	PM10
Total Annual Avoided Emissions from Project	2,908	58,160	34,896	153,502,269.60	9,596.40	1,163.20	154,091,721.20	165,883.60	15,121.60	11,632.00	18,233.16
Total Daily Avoided	7.97	159.34	95.61	420,554.16	26.29	3.19	422,169.10	451.74	41.43	31.87	49.95

SMUD Total Avoided Greenhouse Gas Emissions	
	CO2e
Total Annual (lb)	154,091,721.20
Total Annual (metric tons)	69,894.91
Total 35 year Lifetime	2,446,321.92

Construction Criteria Air Pollutant and Precursor Significance Determination

Phase	ROG (lbs/day)	CO (lbs/day)	NOX (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOX (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (metric tons/yr)
1 - Demolition	5.49	37.14	57.65	8.56	2.56	6.00	3.55	2.30	1.25	0.09	8,965.30	2.47	0.16	409.47
2 - Roads	4.36	33.11	47.48	32.16	2.16	30.00	8.17	1.93	6.24	0.10	10,240.82	1.88	0.66	675.46
3 - Home Run	2.62	16.84	23.66	41.21	1.21	40.00	9.40	1.08	8.32	0.04	3,869.44	1.00	0.06	203.33
4 - Foundation	5.61	30.42	61.91	22.64	2.64	20.00	6.53	2.37	4.16	0.08	7,844.79	2.26	0.11	573.95
5 - WTG	6.91	56.72	59.89	14.51	0.76	12.00	4.67	0.56	2.50	0.20	19,269.75	5.57	0.21	2,740.90
Total Max Unmitigated Emissions	18.08	117.51	190.70	104.57	8.57	96.00	27.65	7.68	19.97	0.31	30,920.35	7.61	0.99	2,740.90
AQMD Threshold	54 lbs/day	NA	54 lbs/day	80 lbs/day	82 lbs/day	BMPs		54 lbs/day						NA
Exceed Threshold?	NO		YES	YES	NO			NO	BMPs					
Total Basic Mitigated Emissions			181.17	104.14	8.14		27.27	7.30						
Additional Mitigated Emissions			144.93	52.48	4.48	48.00	14.00	4.01	9.99					
Exceed Threshold			YES	NO	NO			NO						

Areas in light grey represent overlapping phases.

* YSAQMD threshold of significance for construction and operation PM_{10} is 80 lbs/day, while BAAQMD threshold of significance is 82 lbs/day.

CO2e (metric tons/yr)	CO2e (metric tons/yr)	CO2e (metric tons/yr)
Year 1	Year 2	Total
1,862.21	2,740.90	4,603.11

Basic Construction Mitigation Measure Reductions (BAAQMD 2017)

With water trucks selected, there is a 50% reduction in fugitive dust PM. Water trucks are included as part of the project during construction.

Exhaust Emissions: A 5% reduction was applied for NO_x, PM_{10}, and $PM_{2.5}$ to account for implementation of the appropriate *Basic Construction Mitigation Measures*

Additional Construction Mitigation Measure Reductions (BAAQMD 2017)

Amortized
131.52

An additional 50% reduction was applied to the fugitive PM dust emissions with implementation of the *Additional Construction Mitigation Measures* 1 through 8. This results in a total 75 percent reduction considering above.

Exhaust Emissions: A 20 percent reduction for NO_x and a 45% reduction for PM_{10} and $PM_{2.5\ was\ applied}$ to account for implementation of Measure 9 in the *Additional Construction Mitigation Measures*

Construction Ozone Precursor Annual Emissions

Phase	ROG (tons/phase)	NOX (tons/phase)	
1 - Demolition	0.27	2.84	
2 - Roads	0.38	4.20	
3 - Home Run	0.15	1.46	
4 - Foundation	0.42	4.39	
5 - WTG	0.08	0.57	
Total Construction Emissions	1.30	13.46	
Total 2021 Emissions	1.22	12.89	Total NOx Construction Emissions
YSAQMD Threshold	10 tons/yr	10 tons/yr	
Exceed Threshold?	NO	YES	
Total Basic Mitigated Emissions		12.25	12.78
Additional Mitigated Emissions		9.80	10.23
Exceed Threshold		NO	

Areas in light grey represent overlapping phases over a 10 month period.

Basic Construction Mitigation Measure Reductions (BAAQMD 2017)

Exhaust Emissions: A 5% reduction was applied for NO_X to account for implementation of the appropriate *Basic Construction Mitigation Measures*

Additional Construction Mitigation Measure Reductions (BAAQMD 2017)

Exhaust Emissions: A 20 percent reduction for NO_X was applied to account for implementation of Measure 9 in the *Additional Construction Mitigation Measures*