Appendix A

Air Quality and Greenhouse Gas Emissions

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> 2020-2021 NPW Connections Project

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	1.77	12.08	17.15	1.81	0.81	1.00	0.95	0.74	0.21	0.03	2,739.20	0.60	0.05	2,769.45
Grading/Excavation	2.23	15.42	22.24	1.96	0.96	1.00	1.05	0.84	0.21	0.05	4,729.93	1.15	0.19	4,813.85
Drainage/Utilities/Sub-Grade	0.69	8.02	5.69	1.27	0.27	1.00	0.44	0.23	0.21	0.02	1,565.50	0.29	0.07	1,593.74
Paving	1.10	10.67	10.27	0.47	0.47	0.00	0.40	0.40	0.00	0.03	3,115.10	0.72	0.13	3,172.56
Maximum (pounds/day)	2.23	15.42	22.24	1.96	0.96	1.00	1.05	0.84	0.21	0.05	4,729.93	1.15	0.19	4,813.85
Total (tons/construction project)	0.39	3.11	3.73	0.39	0.17	0.22	0.19	0.15	0.05	0.01	839.81	0.19	0.03	854.35

Notes:

Project Start Year ->	2022
Project Length (months) ->	24
Total Project Area (acres) ->	8
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	0	0	280	40
Grading/Excavation	81	26	140	56	320	40
Drainage/Utilities/Sub-Grade	36	0	56	0	200	40
Paving	0	84	0	140	280	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 -> 2020-2021 NPW Connections Project

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	0.32	0.45	0.05	0.02	0.03	0.03	0.02	0.01	0.00	72.31	0.02	0.00	66.33
Grading/Excavation	0.24	1.63	2.35	0.21	0.10	0.11	0.11	0.09	0.02	0.01	499.48	0.12	0.02	461.17
Drainage/Utilities/Sub-Grade	0.06	0.74	0.53	0.12	0.02	0.09	0.04	0.02	0.02	0.00	144.65	0.03	0.01	133.59
Paving	0.04	0.42	0.41	0.02	0.02	0.00	0.02	0.02	0.00	0.00	123.36	0.03	0.01	113.97
Maximum (tons/phase)	0.24	1.63	2.35	0.21	0.10	0.11	0.11	0.09	0.02	0.01	499.48	0.12	0.02	461.17
Total (tons/construction project)	0.39	3.11	3.73	0.39	0.17	0.22	0.19	0.15	0.05	0.01	839.81	0.19	0.03	775.06

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.

2020-2021 CVWD Non-Potable Water Connections Project

Criteria Air Pollutant Emissions Calculations

Number of Daily Vehicle Trips	1
Maximum Daily VMT	9

Pollutant	Emission Factor Type	Emission Factor		Daily Emissions (grams/day)	Daily Emissions (lbs/day)
ROG	RUNEX	0.090634529	grams/mile	0.82	0.0018
	IDLEX[1]	0	grams/vehicle/day	0.00	0.0000
	STREX	0.152716697	grams/trip	0.15	0.0003
	HOTSOAK	0.099759163	grams/trip	0.10	0.0002
	RUNLOSS	0.31958423	grams/trip	0.32	0.0007
	RESTLOSS	0.056207812	grams/vehicle/day	0.03	0.0001
	DIURN	0.081666863	grams/vehicle/day	0.04	0.0001
				TOTAL	**0.0032**
NO_X	RUNEX	0.373904172	grams/mile	3.37	0.0074
	IDLEX[1]	0	grams/vehicle/day	0.00	0.0000
	STREX	0.111305154	grams/trip	0.11	0.0002
				TOTAL	**0.0077**
CO	RUNEX	4.439593301	grams/mile	39.96	0.0880
	IDLEX[1]	0	grams/vehicle/day	0.00	0.0000
	STREX	0.970511947	grams/trip	0.97	0.0021
				TOTAL	**0.0901**
SO_X	RUNEX	0.010330025	grams/mile	0.09	0.0002
	IDLEX[1]	0	grams/vehicle/day	0.00	0.0000
	STREX	0.000268673	grams/trip	0.00	0.0000
				TOTAL	**0.0002**
PM_{10}	RUNEX	0.006556528	grams/mile	0.06	0.0001
	IDLEX[1]	0	grams/vehicle/day	0.00	0.0000
	STREX	0.001092918	grams/trip	0.00	0.0000
	PMTW	0.027673648	grams/mile	0.25	0.0005
	PMBW	0.127125821	grams/mile	1.14	0.0025
				TOTAL	**0.0032**
$PM_{2.5}$	RUNEX	0.006028666	grams/mile	0.05	0.0001
	IDLEX[1]	0	grams/vehicle/day	0.00	0.0000
	STREX	0.001004932	grams/trip	0.00	0.0000
	PMTW	0.006918412	grams/mile	0.06	0.0001
	PMBW	0.054482495	grams/mile	0.49	0.0011
				TOTAL	**0.0013**

Notes

VMT = vehicle miles traveled; ROG = reactive organic gases; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter measuring no more than 10 microns in diameter; $PM_{2.5}$ = particulate matter measuring no more than 2.5 microns in diameter; RUNEX = Running Exhaust Emissions; IDLEX = Ide Exhaust Emissions (calculated only for heavy-duty trucks; STREX = Start Exhaust Tailpipe Emissions; HOTSOAK = Hot Soak Evaporative Hydrocarbon Emissions; RUNLOSS = Running Loss Evaporative Hydrocarbon Emissions; RESTLOSS = Resting Evaporative Losses; DIURN = Diurnal Evaporative Hydrocarbon Emissions; PMTW = Tire Wear Particulate Matter Emissions; PMBW = Brake Wear Particulate Matter Emissions

[1] According to the CARB EMFAC 2017 Volume 1 - User's Guide (2018), idle exhaust is calculated only for heavy-duty trucks because this process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods.

Emissions factor source: California Air Resources Board EMFAC2017 Web Database v. 1.0.2 Emission Rates for Riverside County for year 2023 for gasoline-fueled LDT1 vehicles.

More information on emission factors can be found in the EMFAC2017 Volume I - User's Guide (2018) available at: https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide-final.pdf

2020-2021 CVWD Non-Potable Water Connections Project

Greenhouse Gas Emissions Calculations

Number of Annual Vehicle Trips	24
Maximum Annual VMT	216

Greenhouse Gas	Emission Factor Type	Emission Factor		Annual Emissions (grams/year)	Annual Emissions (MT/year)	Annual Emissions (MT of CO_2e/year)[1]
CO_2	RUNEX	1043.878561	grams/mile	225477.77	0.2255	0.225
	IDLEX[2]	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	27.15018829	grams/trip	651.60	0.0007	0.001
				TOTAL	**0.2261**	**0.226**
CH_4	RUNEX	0.0209234	grams/mile	4.52	0.0000	0.000
	IDLEX[2]	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.030817402	grams/trip	0.74	0.0000	0.000
				TOTAL	**0.0000**	**0.000**
N_2O	RUNEX	0.028825363	grams/mile	6.23	0.0000	0.002
	IDLEX[2]	0	grams/vehicle/day	0.00	0.0000	0.000
	STREX	0.012375344	grams/trip	0.30	0.0000	0.000
				TOTAL	**0.0000**	**0.002**
CO_2e					**TOTAL**	**0.228**

Notes
VMT = vehicle miles traveled; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; CO_2e = carbon dioxide equivalents; MT = metric tons; RUNEX = Running Exhaust Emissions; IDLEX = Ide Exhaust Emissions (calculated only for heavy-duty trucks; STREX = Start Exhaust Tailpipe Emissions
[1] Assumes a global warming potential of 28 for CH_4 and 265 for N_2O.
[2] According to the CARB EMFAC 2017 Volume 1 - User's Guide (2018), idle exhaust is calculated only for heavy-duty trucks because this process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods.
Emissions factor source: California Air Resources Board EMFAC2017 Web Database v. 1.0.2 Emission Rates for Riverside County for year 2023 for gasoline-fueled LDT1 vehicles.
Global warming potentials for CH_4 and N_2O source: Intergovernmental Panel for Climate Change (2015) Climate Change 2014 Synthesis Report.
More information on emission factors can be found in the EMFAC2017 Volume I - User's Guide (2018) available at: https://ww3.arb.ca.gov/msei/downloads/emfac2017-volume-i-users-guide-final.pdf