Appendix A

Air Quality Calculations

Elder Creek Channel Improvement Project

Project and Emissions Estimate Assumptions

General Assumption

1) Work occurs during daytime hours, up to 8 hours of active operation per day.

Onroad Equipment Emission Calculations Assumptions

1) CARB EMFAC2014 model emission factors for South Coast Air Basin in 2019 are used to estimate on-road emissions. Passenger vehicle emissions are an all fuels composite of LDA, LDT1, LDT2, LHDT1, LHDT2, and MCY vehicles, all delivery and heavy duty trucks are assumed to be diesel-fueled (MHDT and HDDT, respectively). Emissions factors (lb/mile) for each of the three vehicle types based on the total emissions divided by the total miles traveled.
2) Trip estimates for heavy trucks based on materials quantity estimates provided by the County. Additional trips are assumed for inspectors/management staff and sanitary and fuel delivery. Worker trips conservatively estimated as average during each main task.
3) Trip distance assumptions based on County estimate of 20 mile maximum round trip distance for trucks. Employee commutes are based on SCAG regional averages (rounded to 30 mile round trip).
4) Unpaved travel would be limited for this project, with the assumption that bulk material import/export trips require 1/4 mile travel average per trip in unpaved areas. Worker and "delivery" trucks are not assumed to travel on unpaved surfaces.

Offroad Equipment Emission Calculation Assumptions

1) Offroad equipment emissions estimates completed using CARB OFFROAD model fleet average emissions factors.
2) Offroad equipment use estimates were provided by the County.

Fugitive Dust Emission Calculations Assumptions

1) Grading fugitive dust emissions are calculated using USEPA AP-42 section 11.9. Soil handing emission factors for truck loading/unloading and other bulk material drops are calculated using the recent version of USEPA AP-42 Section 13.2.4.
2) Paved road emission factors are calculated using the most current version of USEPA AP-42 Section 13.2.1 and use the following assumptions:
   A) Silt loading is 0.06 g/m2 for 5,000<ADT<10,0000 of Table 13.2.1-2; B) average vehicle weight is calculated on VMT average basis.
2) Unpaved road emission factors are calculated using the most current version of USEPA AP-42 Section 13.2.2 and use the following assumptions:
   A) Silt loading is assumed to be 8.5 percent; B) average vehicle weight is calculated on VMT average basis.
3) Windblown emissions are not assumed to increase from baseline stockpile conditions.
4) Watering and vehicle speed reduction will be required for SCAQMD Rule 403 compliance, and emissions include implementation of these control measures.

(other notes and specific assumptions may be provided on the following calculation sheets)

Elder Creek Channel Improvement Project

Emissions Summary

Criteria Pollutant Emissions Summary

Maximum Daily Regional Emissions - Scenario 1 - Peak Traffic Emissions Period (Churck Street Channel muck out and Rock Slope Protection)

Emissions Source	VOC (lb/day)	CO (lb/day)	NOX (lb/day)	SOX (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)
Onroad	0.66	4.25	10.75	0.04	0.06	0.05
Offroad	1.10	11.82	10.26	0.02	0.54	0.50
Fugitive Dust	--	--	--	--	13.21	1.85
Total	**1.76**	**16.06**	**21.01**	**0.06**	**13.81**	**2.40**

(This is the regional maximum PM10/PM2.5 case, due to peak daily fugitive dust emissions)

Maximum Daily Regional Emissions - Scenario 2 - Sheet Piling Option w/Overlapping Tasks

Emissions Source	VOC (lb/day)	CO (lb/day)	NOX (lb/day)	SOX (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)
Onroad	0.72	4.91	8.21	0.04	NA	NA
Offroad	2.58	21.42	24.68	0.04	NA	NA
Fugitive Dust	--	--	--	--	NA	NA
Total	**3.30**	**26.33**	**32.89**	**0.08**	NA	NA

(See Scenario 1 for peak PM10/PM2.5 regional daily emissions)

Maximum Daily Regional Emissions - Scenario 3 - Paving Period with Overlapping Task

Emissions Source	VOC (lb/day)	CO (lb/day)	NOX (lb/day)	SOX (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)
Onroad	0.63	4.20	8.35	0.04	NA	NA
Offroad	1.67	16.17	16.64	0.02	NA	NA
Fugitive Dust	--	--	--	--	NA	NA
Total	**2.29**	**20.37**	**24.99**	**0.06**	NA	NA

(See Scenario 1 for peak PM10/PM2.5 regional daily emissions)

Maximum Daily On-site LST Emissions

Emissions Source	VOC (lb/day)	CO (lb/day)	NOX (lb/day)	SOX (lb/day)	PM10 (lb/day)	PM2.5 (lb/day)
Onroad	NA	NA	NA	NA	NA	NA
Offroad	NA	6.46	12.28	NA	0.52	0.47
Fugitive Dust	--	--	--	--	Neg.	Neg.
Total	**NA**	**6.46**	**12.28**	**NA**	**0.52**	**0.47**

Elder Creek Channel Improvement Project

Emissions Summary

GHG Emissions Summary

Base Case

Emissions Source	CO2e MT
Onroad	229
Offroad	110
Indirect Water Use	7
Total	347

Sheet Pile Option

Emissions Source	CO2e MT
Onroad	235
Offroad	157
Indirect Water Use	7
Total	399

Note CO_2 is nearly equivalent to CO2e for on- and off-road engine emissions sources, a conservative five percent increase adjustment is made for the CH_4 and N_2O emissions.

Elder Creek Channel Improvement Project

On-Road Vehicle Emissions

Assumptions:

1. Vehicle emissions are based on fleet average for 2020.

Emissions Factors lbs/mile (EMFAC2014 2020 - Coast Air Basin)

Vehicle	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Passenger	0.0004	0.0031	0.0003	0.0000	0.0000	0.0000	0.8413691
Delivery	0.0002	0.0008	0.0051	0.0000	0.0001	0.0001	2.54916171
HDDT	0.0003	0.0019	0.0106	3.55E-05	4.41E-05	4.22E-05	3.85559141

Total Vehicle Travel (Off-site) Emissions

		Emissions (lbs)						
Vehicle	Total VMT	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Passenger	124,020	50.79	386.68	39.18	1.05	0.77	0.71	104,347
Delivery	15,640	3.18	11.74	80.01	0.38	1.76	1.69	39,869
HDDT	70,200	23.60	130.15	746.40	2.49	3.09	2.96	270,663
	Totals	77.57	528.56	865.59	3.92	5.63	5.36	414,878

Total Vehicle Travel (Off-site) Emissions - Sheet Pile Option

		Emissions (lbs)						
Vehicle	Total VMT	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
Passenger	136,020	55.70	424.09	42.97	1.15	0.85	0.78	114,443
Delivery	15,640	3.18	11.74	80.01	0.38	1.76	1.69	39,869
HDDT	70,600	23.74	130.89	750.65	2.51	3.11	2.98	272,205
	Totals	82.62	566.72	873.63	4.03	5.72	5.45	426,517

Total On-site Vehicle Working Emissions

		Emissions (lbs)						
Vehicle	Total VMT	VOC	CO	NOx	SOx	PM10	PM2.5	CO2
HDDT	17,200	5.78	31.89	182.88	0.61	0.76	0.73	66,316

Maximum Daily Emissions - Scenario 1 - Peak Traffic Emissions Period (Church Street Channel muck out and Rock Slope Protection)

		Emissions (lbs)					
Vehicle	Total VMT	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	780	0.32	2.43	0.25	0.01	0.00	0.00
Delivery	100	0.02	0.08	0.51	0.00	0.01	0.01
HDDT	940	0.32	1.74	9.99	0.03	0.04	0.04
	Totals	0.66	4.25	10.75	0.04	0.06	0.05

Elder Creek Channel Improvement Project

On-Road Vehicle Emissions

Alternative Maximum Daily Emissions - Scenario 2 - Sheet Piling Option

		Emissions (lbs)					
Vehicle	Total VMT	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	1140	0.47	3.55	0.36	0.01	0.01	0.01
Delivery	80	0.02	0.06	0.41	0.00	0.01	0.01
HDDT	700	0.24	1.30	7.44	0.02	0.03	0.03
	Totals	0.72	4.91	8.21	0.04	0.05	0.04

Alternative Maximum Daily Emissions - Scenario 3 - Paving Abbey and Merris

		Emissions (lbs)					
Vehicle	Total VMT	VOC	CO	NOx	SOx	PM10	PM2.5
Passenger	900	0.37	2.81	0.28	0.01	0.01	0.01
Delivery	80	0.02	0.06	0.41	0.00	0.01	0.01
HDDT	720	0.24	1.33	7.66	0.03	0.03	0.03
	Totals	0.63	4.20	8.35	0.04	0.05	0.04

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Assumption:

1) All work tasks are done using single set of work crews and equipment except for Demo north of Meris which uses two crews working in different areas of the channel.

Equipment Emissions Factors (lbs/hour)

	HP	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	164	0.04935	0.43881	0.45834	0.00063	0.02523	0.02321	68.67
Excavator	162	0.03158	0.41866	0.31053	0.00066	0.01509	0.01389	71.60
Skip Loader	104	0.02679	0.30175	0.27214	0.00041	0.01703	0.01567	44.75
Generator	50	0.03027	0.31768	0.24091	0.00030	0.01065	0.00980	32.32
Breakdown Roller	100.6	0.03186	0.29497	0.32021	0.00041	0.02037	0.01874	44.46
Paving Machine	142	0.03662	0.39609	0.38895	0.00064	0.01918	0.01765	69.36
Steel Roller	100.6	0.03186	0.29497	0.32021	0.00041	0.02037	0.01874	44.46
Rubber Tire Roller	100.5	0.03182	0.29468	0.31989	0.00041	0.02035	0.01872	44.42
Grader	130	0.06522	0.42005	0.63662	0.00057	0.03554	0.03269	61.99
Backhoe/Loader	104	0.02679	0.30175	0.27214	0.00041	0.01703	0.01567	44.75
Alternative Maximum Onsite Emissions Equipment - Silent Sheet Piling (North of Merris RCB Demo)								
Power Unit	316	0.09329	0.46961	0.67126	0.00189	0.02914	0.02681	204.29
Crane	300	0.07194	0.33770	0.86341	0.00093	0.03530	0.03248	101.19

Task Emissions

Remove Stockpile		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	4	0.126	1.675	1.242	0.003	0.060	0.056	137	17.31	229.43	170.17	0.36	8.27	7.61	39,235
Loader	4	0.197	1.755	1.833	0.003	0.101	0.093	137	27.04	240.47	251.17	0.35	13.83	12.72	37,629

Channel North of Merris

Demo existing channel and RCB (2 crews)		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	16	0.505	6.699	4.968	0.011	0.241	0.222	40	20.21	267.94	198.74	0.42	9.66	8.89	45,822
Skip Loader	16	0.429	4.828	4.354	0.007	0.272	0.251	40	17.14	193.12	174.17	0.26	10.90	10.03	28,643

Grade subgrade		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	1	0.39	3.51	3.67	0.01	0.20	0.19	549

Place steel invert and forms		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	5	1.07	12.07	10.89	0.02	0.68	0.63	1,790

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Place concrete invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	4	0.97	10.17	7.71	0.01	0.34	0.31	1,034

Place steel for channel walls and forms		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	10	2.14	24.14	21.77	0.03	1.36	1.25	3,580

Place concrete walls		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	8	1.94	20.33	15.42	0.02	0.68	0.63	2,069

Place 48" RCP and Headwall		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Backhoe/Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	1	0.21	2.41	2.18	0.00	0.14	0.13	358
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	1	0.24	2.54	1.93	0.00	0.09	0.08	259

Backfill walls and grading		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Backhoe/Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	2	0.43	4.83	4.35	0.01	0.27	0.25	716

RCB at Merris

Demo asphalt and RCB		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	8	0.253	3.349	2.484	0.005	0.121	0.111	3	0.76	10.05	7.45	0.02	0.36	0.33	1,718
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	3	0.64	7.24	6.53	0.01	0.41	0.38	1,074

Relocate utilities		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Backhoe/Loader	4	0.107	1.207	1.089	0.002	0.068	0.063	3	0.32	3.62	3.27	0.00	0.20	0.19	537

Grade subgrade		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	1	0.39	3.51	3.67	0.01	0.20	0.19	549

Place steel and forms for RCB invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	1	0.21	2.41	2.18	0.00	0.14	0.13	358

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Place concrete for RCB invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	1	0.24	2.54	1.93	0.00	0.09	0.08	259

Place steel and forms for walls and deck		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	2	0.43	4.83	4.35	0.01	0.27	0.25	716

Place concrete for RCB walls and deck		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	1	0.24	2.54	1.93	0.00	0.09	0.08	259

backfill RCB after 7 days		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	4	0.197	1.755	1.833	0.003	0.101	0.093	2	0.39	3.51	3.67	0.01	0.20	0.19	549
Excavator with sheep foot	4	0.126	1.675	1.242	0.003	0.060	0.056	2	0.25	3.35	2.48	0.01	0.12	0.11	573

Concrete Channel btw Abbey and Merris

Grade subgrade		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	8	0.253	3.349	2.484	0.005	0.121	0.111	2	0.51	6.70	4.97	0.01	0.24	0.22	1,146
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	2	0.79	7.02	7.33	0.01	0.40	0.37	1,099

Place steel and forms for channel invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	2	0.43	4.83	4.35	0.01	0.27	0.25	716

Place concrete invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	3	0.73	7.62	5.78	0.01	0.26	0.24	776

Place steel in walls and forms		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	5	1.07	12.07	10.89	0.02	0.68	0.63	1,790

Place concrete walls		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	4	0.97	10.17	7.71	0.01	0.34	0.31	1,034

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Backfill Walls and grading		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator with sheep foot	8	0.253	3.349	2.484	0.005	0.121	0.111	2	0.51	6.70	4.97	0.01	0.24	0.22	1,146
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	2	0.79	7.02	7.33	0.01	0.40	0.37	1,099

RCB at Abbey

Demo asphalt and RCB		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	8	0.253	3.349	2.484	0.005	0.121	0.111	3	0.76	10.05	7.45	0.02	0.36	0.33	1,718
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	3	0.64	7.24	6.53	0.01	0.41	0.38	1,074

Relocate utilities		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Backhoe/Loader	4	0.107	1.207	1.089	0.002	0.068	0.063	3	0.32	3.62	3.27	0.00	0.20	0.19	537

Grade subgrade		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	1	0.39	3.51	3.67	0.01	0.20	0.19	549

Place steel and forms for RCB invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	1	0.21	2.41	2.18	0.00	0.14	0.13	358

Place concrete for RCB invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	1	0.24	2.54	1.93	0.00	0.09	0.08	259

Place steel and forms for walls and deck		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	2	0.43	4.83	4.35	0.01	0.27	0.25	716

Place concrete for RCB walls and deck		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	2	0.48	5.08	3.85	0.00	0.17	0.16	517

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Backfill RCB after 7 days		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	2	0.79	7.02	7.33	0.01	0.40	0.37	1,099
Excavator with sheep foot	8	0.253	3.349	2.484	0.005	0.121	0.111	2	0.51	6.70	4.97	0.01	0.24	0.22	1,146

Paving Abbey and Merris		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	1	0.39	3.51	3.67	0.01	0.20	0.19	549
Breakdown Roller	8	0.255	2.360	2.562	0.003	0.163	0.150	1	0.25	2.36	2.56	0.00	0.16	0.15	356
Paving machine	8	0.293	3.169	3.112	0.005	0.153	0.141	1	0.29	3.17	3.11	0.01	0.15	0.14	555
Steel roller	8	0.255	2.360	2.562	0.003	0.163	0.150	1	0.25	2.36	2.56	0.00	0.16	0.15	356
Rubber tire roller	8	0.255	2.357	2.559	0.003	0.163	0.150	1	0.25	2.36	2.56	0.00	0.16	0.15	355

Concrete Channel downstream of Abbey

Grading downstream of Abbey		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	8	0.253	3.349	2.484	0.005	0.121	0.111	5	1.26	16.75	12.42	0.03	0.60	0.56	2,864
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	5	1.97	17.55	18.33	0.03	1.01	0.93	2,747
Grader	8	0.522	3.360	5.093	0.005	0.284	0.262	5	2.61	16.80	25.46	0.02	1.42	1.31	2,480

Place steel and forms for invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	4	0.86	9.66	8.71	0.01	0.54	0.50	1,432

Place concrete for invert		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	2	0.48	5.08	3.85	0.00	0.17	0.16	517

Place steel and forms for walls		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	7	1.50	16.90	15.24	0.02	0.95	0.88	2,506

Place Concrete for walls		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	4	0.97	10.17	7.71	0.01	0.34	0.31	1,034

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Backfill and Grading		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	2	0.79	7.02	7.33	0.01	0.40	0.37	1,099
Excavator with sheep foot	8	0.253	3.349	2.484	0.005	0.121	0.111	2	0.51	6.70	4.97	0.01	0.24	0.22	1,146

Grade earthen channel		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	8	0.253	3.349	2.484	0.005	0.121	0.111	5	1.26	16.75	12.42	0.03	0.60	0.56	2,864
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	5	1.97	17.55	18.33	0.03	1.01	0.93	2,747
Grader	8	0.522	3.360	5.093	0.005	0.284	0.262	5	2.61	16.80	25.46	0.02	1.42	1.31	2,480

Fencing		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	10	2.14	24.14	21.77	0.03	1.36	1.25	3,580
Generator	8	0.242	2.541	1.927	0.002	0.085	0.078	10	2.42	25.41	19.27	0.02	0.85	0.78	2,586

Church Street Channel muck out		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	3	1.18	10.53	11.00	0.02	0.61	0.56	1,648

Rock slope protection and cobble on berm		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Excavator	8	0.253	3.349	2.484	0.005	0.121	0.111	10	2.53	33.49	24.84	0.05	1.21	1.11	5,728

Final grading/cleanup		Daily Emissions (lbs/day)							Total Emissions (lbs)						
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5	Days	VOC	CO	NOX	SOX	PM10	PM2.5	CO2
Loader	8	0.395	3.510	3.667	0.005	0.202	0.186	5	1.97	17.55	18.33	0.03	1.01	0.93	2,747
Skip Loader	8	0.214	2.414	2.177	0.003	0.136	0.125	5	1.07	12.07	10.89	0.02	0.68	0.63	1,790
Grader	8	0.522	3.360	5.093	0.005	0.284	0.262	5	2.61	16.80	25.46	0.02	1.42	1.31	2,480

Alternative Maximum Day Emissions - Scenario 1 - Peak Traffic Emissions Period (Churck Street Channel muck out and Rock Slope Protection)

Maximum Daily Emissions (lbs/day)					
VOC	CO	NOX	SOX	PM10	PM2.5
1.104	11.815	10.255	0.016	0.544	0.500

Total Project Offroad Emissions (lbs)						
VOC	CO	NOX	SOX	PM10	PM2.5	CO2
135.75	1481.19	1304.76	2.14	70.53	64.88	231698.79

Elder Creek Channel Improvement Project

Offroad Equipment Tailpipe Emissions

Alternative Maximum Day Emissions - Scenario 2 - Sheet Pile Option w/Task Overlaps (two crews for North of Merris work)

		Maximum Daily Emissions (lbs/day)					
	Hours/Day	VOC	CO	NOX	SOX	PM10	PM2.5
Power Unit	8	0.746	3.757	5.370	0.015	0.233	0.214
Crane	8	0.576	2.702	6.907	0.007	0.282	0.260
Demo Phase/Stockpile Removal Overlap		1.258	14.957	12.398	0.022	0.675	0.621
Totals		2.579	21.415	24.676	0.045	1.191	1.095

Total Project Offroad Emissions (lbs) - Sheet Pile Option						
VOC	CO	NOX	SOX	PM10	PM2.5	CO2
188.62	1739.53	1795.85	3.04	91.15	83.85	329451.08

While the offroad emissions are higher during the potential option for sheet piling, the onroad emissions would be considerably lower, so the regional maximum could occur during other overlaps, so these other potential maximum overlaps are estimated.

Alternative Maximum Day - Scenario 3 - Paving Abbey and Merris w/overlapping task

	Maximum Daily Emissions (lbs/day)					
	VOC	CO	NOX	SOX	PM10	PM2.5
Total Emissions	1.666	16.170	16.638	0.023	0.980	0.902

LST Maximum - Single construction activity at or north of Merris near resdential receptors (sheet pile option - single crew)

	Maximum Daily Emissions (lbs/day)					
	VOC	CO	NOX	SOX	PM10	PM2.5
LST Emissions	NA	6.459	12.277	NA	0.516	0.474

Elder Creek Channel Improvement Project

Indirect Greenhouse Gas Emissions

Indirect Water Use CO2e Emissions

Assumption:

1. This is assumed to be based on 11.111 MWh per million gallons or 3.62 MWh per acre-foot (Navigant, 2006; p. 2), with approximately 16 acre-feet of water required during construction (~12,000 gallons per day average); and 661.24 lbs of CO2e/MWh (equivalent to approximately 1.2 tons of CO2e/acre-foot of water).

	Acre-feet	MWh/Ac-ft	CO2e/MWh	CO2E
Construction	6.7	3.62	661.24	7.28
			lbs/MWh	Metric Tons

Elder Creek Channel Improvement Project

Fugitive Dust Emissions

General Assumptions:

1. Fugitive dust emissions are estimated using AP-42.
2. Rule 403 compliance is assumed, so "unmitigated" emissions factors include watering/moist soil, track out control, and vehicle speed reduction on unpaved surfaces.

Emission Categories

1) Earthmoving
a) Grading
b) Material Loading/Handling
2) Paved Road Dust
3) Unpaved Road Dust

1) Earthmoving

a) Grading (AP-42 Section 11.9)

$E = k \times 0.051 \times (S)^{2.0}$ for PM10 and $k \times 0.040 \times (S)^{2.5}$ for PM2.5
E = lb/VMT
k = Scaling Constant (0.60 for PM10 and 0.031 for PM2.5)
S = Mean Vehicle Speed assumed to be 3 mph
Assumes VMT = 3 x hours in use

Emission Factor, lb/VMT

PM10	PM2.5
0.08813	0.00619

Emission Control
68%

Watering is assumed as Rule 403 control measure.

Maximum Daily Grader Use

Hrs	VMT/day	
8	24	Daily
120	360	Total

Grading Emissions (Lbs)

PM10	PM2.5	
2.12	0.15	Daily
31.73	2.23	Total

b) Material Loading/Handling (AP-42, p. 13.2.4.3)

$E = (k)(0.0032)[(U/5)^{1.3}]/[(M/2)^{1.4}]$
E = lb/ton
k = Particle Size Constant (0.35 for PM10 and 0.053 for PM2.5)
U = average wind speed = 15 MPH worst-case/average
M = moisture content = 12% per compliance with Rule 403
Two separate drops are assumed for bulk material movement as a worst-case daily (one drop for localized daily)
Bulk material trips are assumed to be 25 tons per trip

Throughput	Tons	
31 Trips	1550	Maximum Daily
12 Trips	300	Maximum Localized Daily
2414 Trips	120700	Total

Emission Factors and Emissions
Emission Factors

PM10	PM2.5
0.00038	0.00006

Emissions (Lbs)

PM10	PM2.5	
0.59	0.09	Daily
0.11	0.02	Maximum Localized Daily
45.90	6.95	Total

2) Paved Road Dust

$E = [k \times (sL)^{0.91 \times} (W)^{1.02}] * (1-P/4N)$
E = lb/VMT
k = Constant (0.0022 for PM10 and 0.00054 for PM2.5)

sL = Silt Loading (conservatively assumed to be 0.06 g/m2 - Table 13.2.1-2)
W = Average weight of vehicles in tons (calculated below)
P = Days of precipitation (34 assumed for project total calculation)
N = Days in period (365 for project total calculation)

Average Vehicle Weight Calculation

Assumptions
Passenger Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 12 ton average
Heavy-Heavy Duty Trucks = 27 tons average (loaded 40 tons, unloaded 14 tons)

VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Paved VMT	Average Weight (Tons)
Maximum Day	780	100	940	1,820	17.0
Project Total	124,020	15,640	70,200	209,860	12.1

Daily Emission Factors (lb/VMT)

Case	PM10 Daily	PM2.5 Daily
Maximum Day	0.00212	0.00052

Emissions (Lbs/day)

Max Day	PM10	PM2.5
Maximum Daily	3.85	0.95

Project Total Emission Factors (lb/VMT)

Max Day	PM10 Daily	PM2.5 Daily
Project Total	0.00113	0.00028

Emissions (Lbs)

Max Day	PM10	PM2.5
Project Total	236.14	59.34

B) Unpaved Road Dust

$E = (k)[(s/12)^{0.9}][(W/3)^{0.45}][(365-P)/365]$

k = constant = 1.5 lb/VMT for PM10 and 0.15 lb/VMT for PM2.5
s = Silt Content (assumed to be 8.5%, USEPA for overburden for dirt roads and 4% for gravel road - SCAQMD handbook)
W = avg. vehicle weight = calculated below
P = Days of precipitation (34 assumed for project total calculation)

Average Vehicle Weight Calculation

Assumptions:
Passenger Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 12 ton average
Heavy-Heavy Duty Trucks = 27 tons average (loaded 40 tons, unloaded 14 tons)

VMT	Passenger Vehicles	Delivery/Work Vehicles	Heavy-Heavy Duty Vehicles	Total Unpaved VMT	Average Weight
Max Daily	0	0	11	11	27.0
Total	0	0	750	750	27.0

Controlled Emissions (assumes Rule 403 required 55% for watering and 57% for 15 MPH speed limit, for total of 80 percent)

Emission Factors (lb/VMT)

	PM10 Daily	PM2.5 Daily
Maximum Daily	0.59	0.06
Total	0.54	0.05

Emissions (Lbs)

	PM10	PM2.5
Maximum Daily	6.65	0.67
Total	402.11	40.21

Fugitive Dust Emissions Summary

Maximum Day

	Maximum Lbs/Day		Project Total Lbs	
	PM10	PM2.5	PM10	PM2.5
Grading	2.12	0.15	31.73	2.23
Material Loading/Handling	0.59	0.09	45.90	6.95
Paved Road Dust	3.85	0.95	236.14	59.34
Unpaved Road Dust	6.65	0.67	402.11	40.21
Total	13.21	1.85	715.86	108.73

Maximum Day for regional particulate emissions is based on maximum vehicle emissions day.

Localized Maximum Day

	Maximum Lbs/Day		
	PM10	PM2.5	
Grading	NA	NA	Use of graders does not occur near sensitive receptors
Material Loading/Handling	0.11	0.02	
Paved Road Dust	NA	NA	Paved road dust is not an onsite emissions source
Unpaved Road Dust	NA	NA	Negligible unpaved travel near sensitive receptors
Total	0.11	0.02	

Elder Creek Channel Improvement Project

Onsite DPM Emissions Distributed Screening Level Risk Receptor Annual Concentration Calculation

Main Construction Task/Area	Offroad Emissions	Onroad Emissions	Emissions Interval	Distance to Receptor	SCAQMD X/Q	Emissions Fraction	Calculated ug/M3
North of Merris	44.94	NA	250.00	25	3.76	10.00%	0.008
				50	1.92	10.00%	0.004
				75	1.38	10.00%	0.003
				100	0.97	35.00%	0.008
				200	0.28	35.00%	0.002
Paving/RCB @ Merris	4.71	0.76	NA	25	3.76	100%	0.010
Between Abbey and Merris	3.45	NA	150.00	25	3.76	16.67%	0.001
				50	1.92	16.67%	0.001
				75	1.38	16.67%	0.000
				100	0.97	16.67%	0.000
				150	0.625	33.33%	0.000
Paving/RCB @ Abbey	2.91	NA		150	0.625	100%	0.001
South of Merris	35.14	NA	NA	200	0.28	100%	0.005
						Total	0.044

Notes:

1) Emissions are total offroad emissions and the on-site on-road emissions (water trucks and concrete pump trucks), where the on-road emissions are conservatively all distributed within 25 meters of the maximum exposed receptor.

2) The emissions interval is the length of the construction area that requires emissions to be distributed at different distances from the maximum exposed receptor.

3) The distance to receptor provides emissions estimates within specific distances to the maximum exposed receptor from that main construction task.

4) The SCAQMD X/Q is in units of [µg/m3]/[ton/year], and it is from the SCAQMD Risk Assessment Procedures for Rules 1401, 1401.1, and 212, Permit Application Package "N" Table 10.4 A for Redlands and engines rating total between 400 and 600 hp.