

**B.F. Sisk Dam Safety of Dam
Modification Project
Environmental Impact
Statement / Environmental Impact
Report**

Appendix D1: Greenhouse Gas Emission Calculations

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GHG Construction Emissions Summary

Table D-1. Reservoir Restriction Alternative

Source	CO ₂ , MT/project	CH ₄ , MT/project	N ₂ O, MT/project	CO ₂ e, MT/project	CO ₂ e, MT/yr
Onsite Construction Emissions	1,018	0	0	1,025	1,025
Construction Worker Commuting	150	0	0	155	155
Total Construction Emissions	1,168	0	0	1,181	1,181
Significance Threshold	n/a	n/a	n/a	25,000	12,500
Significant?	n/a	n/a	n/a	No	No

Note:

Total emissions are equal to sum of amortized construction emissions and operations.

Table D-2. Crest Raise Alternative (Shear Key Option)

Source	CO ₂ , MT/project	CH ₄ , MT/project	N ₂ O, MT/project	CO ₂ e, MT/project	CO ₂ e, MT/yr
Onsite Construction Equipment	115,759	6	1	116,093	15,488
Construction Worker Commuting	6,856	4	0	7,092	709
Haul Truck Trips	22,369	0	0	22,391	2,239
Total Construction Emissions	144,984	10	1	145,575	18,437
Significance Threshold	n/a	n/a	n/a	25,000	12,500
Significant?	n/a	n/a	n/a	Yes	Yes

Note:

Total emissions are equal to sum of amortized construction emissions and operations.

Table D-3. Crest Raise Alternative (No Shear Key)

Source	CO ₂ , MT/project	CH ₄ , MT/project	N ₂ O, MT/project	CO ₂ e, MT/project	CO ₂ e, MT/yr
Onsite Construction Equipment	73,571	5	1	73,846	13,405
Construction Worker Commuting	5,485	3	0	5,673	709
Haul Truck Trips	22,369	0	0	22,391	2,799
Total Construction Emissions	101,426	8.05	0.95	101,910	16,913
Significance Threshold	n/a	n/a	n/a	25,000	12,500
Significant?	n/a	n/a	n/a	Yes	Yes

Note:

Total emissions are equal to sum of amortized construction emissions and operations.

Reservoir Restriction Alternative

Table D-4. Unmitigated Annual Emissions Summary

Source	CO2, MT/project	CH4, MT/project	N2O, MT/project	CO2e, MT/project
Temporary Access Road Construction				
Onsite Construction Emissions	107.2	0.0	0.0	108.6
Construction Worker Commuting	7.7	0.0	0.0	7.9
Temporary Access Road Construction Subtotal	114.9	0.0	0.0	116.5
Obliterate Access Road				
Onsite Construction Emissions	77.8	0.0	0.0	79.1
Construction Worker Commuting	6.1	0.0	0.0	6.3
Obliterate Access Road Subtotal	83.9	0.0	0.0	85.5
Seed Exposed Reservoir Slopes				
Grading Support				
Onsite Construction Emissions	282.1	0.0	0.0	286.1
Construction Worker Commuting	13.8	0.0	0.0	14.3
Grading Support Subtotal	295.9	0.0	0.0	300.4
Seeding Subcontractor				
Onsite Construction Emissions	550.7	0.0	0.0	551.4
Construction Worker Commuting	122.6	0.1	0.0	126.8
Seeding Subcontractor Subtotal	673.3	0.1	0.0	678.2
Seed Exposed Reservoir Slopes Total	969.2	0.1	0.0	978.6
Grand Total	1,168.0	0.1	0.0	1,180.6

Reservoir Restriction Alternative

Table D-5. Onsite Construction Emissions

Quantity	Equipment Description-- General	OFFROAD Equipment	Fuel Type	Size (hp)	CO2	CH4	N2O	Unit	CO2, MT/project	CH4, MT/project	N2O, MT/project	CO2e, MT/project
Temporary Access Road Construction												
1	5000 gal water truck--full time	n/a	Diesel	n/a	46,261.87	0.20	0.19	g/hr	34.42	0.00	0.00	34.47
2	Cat D6R size dozers-Full time	ConstMin - Crawler Tractors	Diesel	175	226.35	0.01	0.01	g/hp-hr	58.94	0.00	0.00	59.47
1	Crewcab 4x4 pickup	n/a	Gasoline	n/a	18,663.36	18.42	1.99	g/hr	13.89	0.01	0.00	14.67
Temporary Access Road Construction Subtotal									107.24	0.02	0.00	108.61
Obliterate Access Road												
1	5000 gal water truck--full time	n/a	Diesel	n/a	46,261.87	0.20	0.19	g/hr	34.42	0.00	0.00	34.47
1	Cat D6R size dozers-Full time	ConstMin - Crawler Tractors	Diesel	175	226.35	0.01	0.01	g/hp-hr	29.47	0.00	0.00	30.01
1	Crewcab 4x4 pickup	n/a	Gasoline	n/a	18,663.36	18.42	1.99	g/hr	13.89	0.01	0.00	14.67
Obliterate Access Road Subtotal									77.77	0.02	0.00	79.15
Seed Exposed Reservoir Slopes												
Grading Support												
2	4000 gal water trucks	n/a	Diesel	n/a	46,261.87	0.20	0.19	g/hr	68.84	0.00	0.00	68.93
2	Cat 14H size motorgraders	ConstMin - Graders	Diesel	240	215.88	0.01	0.01	g/hp-hr	77.10	0.00	0.00	78.51
2	Cat D6R size dozers	ConstMin - Crawler Tractors	Diesel	175	226.35	0.01	0.01	g/hp-hr	58.94	0.00	0.00	60.02
1	Cat 623 size scraper	ConstMin - Scrapers	Diesel	407	255.00	0.01	0.01	g/hp-hr	77.22	0.00	0.00	78.63
Grading Support Subtotal									282.09	0.01	0.01	286.10
Seeding Subcontractor												
4	Hydroseed trucks	n/a	Diesel	n/a	46,261.87	0.20	0.19	g/hr	550.70	0.00	0.00	551.44
Grand Total									1,017.81	0.05	0.02	1,025.29

Source: CARB 2007; Hart 2017.

Conversions
1,000,000 grams per metric ton

Construction Start Year
2020

Onsite vehicle speed
40 mph

Global Warming Potential
CO2 1
CH4 25
N2O 298

Operating Schedule
7 days per week
31 days per month
12 hours per day

Table D-6. Phase Durations

Phase	Duration (Months)
Temporary Access Road Construction	2
Obliterate Access Road	2
Seed Exposed Reservoir Slopes	
Grading Support	2
Seeding Subcontractor	8
Total	14

**Reservoir Restriction Alternative
 Construction Worker Commuting Emissions**

Table D-7. Annual Emissions (tons per year)

Source	No. Employees	Months per Phase	CO ₂ , g/mi	CH ₄ , g/mi	N ₂ O, g/mi	CO ₂ , MT/project	CH ₄ , MT/project	N ₂ O, MT/project	CO ₂ e, MT/project
Temporary Access Road Construction	5	2	308.94	0.1838	0.0202	7.66	0.00	0.00	7.93
Obliterate Access Road	4	2	308.94	0.1838	0.0202	6.13	0.00	0.00	6.34
Seed Exposed Reservoir Slopes									
Grading Support	9	2	308.94	0.1838	0.0202	13.79	0.01	0.00	14.27
Seeding Subcontractor	20	8	308.94	0.1838	0.0202	122.59	0.07	0.01	126.80
Total	38		n/a	n/a	n/a	150.17	0.09	0.01	155.33

7

One-way trip distance

Workers 40 miles per trip

Conversions

1,000,000 grams per metric ton

Construction Start Year

2020

Global Warming Potential

CO₂ 1
 CH₄ 25
 N₂O 298

Operating Schedule

5 days per week
 31 days per month
 2 trips per day

CH4 and N2O Emission Factors

Table D-8. San Joaquin Valley Emission Factors

Year	Type	Fuel	VMT	CH4 (g/mi)	N2O (g/mi)
2020	LDA	GAS	51,905,504	0.1780	0.0197
		DSL	526,303	0.0006	0.0012
	LDT	GAS	21,727,734	0.2024	0.0220
		DSL	35,164	0.0011	0.0017
Weighted Average Emission Factor				0.1838	0.0202

Table D-9. Emission Factors for Highway Vehicles by Technology Type

Vehicle Type/Control Technology	CH4 (g/mi)	N2O (g/mi)
Gasoline Passenger Cars		
EPA Tier 2	0.0173	0.0036
Low Emission Vehicles	0.0105	0.0150
EPA Tier 1	0.0271	0.0429
EPA Tier 0	0.0704	0.0647
Oxidation Catalyst	0.1355	0.0504
Non-Catalyst Control	0.1696	0.0197
Uncontrolled	0.1780	0.0197
Gasoline Light Trucks (Vans, Pickup Trucks, SUVs)		
EPA Tier 2	0.0163	0.0066
Low Emission Vehicles	0.0148	0.0157
EPA Tier 1	0.0452	0.0871
EPA Tier 0	0.0776	0.1056
Oxidation Catalyst	0.1516	0.0639
Non-Catalyst Control	0.1908	0.0218
Uncontrolled	0.2024	0.0220
Gasoline Medium and Heavy-Duty Vehicles Trucks and Busses		
EPA Tier 2	0.0333	0.0134
Low Emission Vehicles	0.0303	0.0320
EPA Tier 1	0.0655	0.1750
EPA Tier 0	0.2630	0.2135
Oxidation Catalyst	0.2356	0.1317
Non-Catalyst Control	0.4181	0.0473
Uncontrolled	0.4604	0.0497
Diesel Passenger Cars		
Advanced	0.0005	0.0010
Moderate	0.0005	0.0010
Uncontrolled	0.0006	0.0012
Diesel Light Trucks		
Advanced	0.0010	0.0015
Moderate	0.0009	0.0014
Uncontrolled	0.0011	0.0017
Diesel Medium and Heavy-Duty Vehicles (Trucks and Busses)		
Aftertreatment	0.0051	0.0048
Advanced	0.0051	0.0048
Moderate	0.0051	0.0048
Uncontrolled	0.0051	0.0048
Motorcycles		
Non-Catalyst Control	0.0672	0.0069
Uncontrolled	0.0899	0.0087

Source: The Climate Registry. 2018. The Climate Registry 2018 Default Emission Factor Document.

Table D-10. Emission Factors from Non-Highway Vehicles

Vehicle Type / Fuel Type	CH4 (g/gallon)	N2O (g/gallon)
Ships and Boats		
Residual Fuel Oil	0.11	0.60
Diesel Fuel	0.06	0.45
Gasoline	0.64	0.22
Locomotives		
Diesel Fuel	0.80	0.26
Agricultural Equipment		
Gasoline	1.26	0.22
Diesel Fuel	1.44	0.26
Construction/Mining Equipment		
Gasoline	0.50	0.22
Diesel Fuel	0.58	0.26
Other Non-Highway		
Snowmobiles (Gasoline)	0.50	0.22
Other Recreational (Gasoline)	0.50	0.22
Other Small Utility (Gasoline)	0.50	0.22
Other Large Utility (Gasoline)	0.50	0.22
Other Large Utility (Diesel)	0.58	0.26
Aircraft		
Jet Fuel		0.31
Aviation Gasoline	7.05	0.11

Source: The Climate Registry. 2018. The Climate Registry 2018 Default Emission Factor Document.

Crest Raise Alternative - Shear Key Option

Table D-11. Unmitigated Annual Emissions Summary

Source	CO₂, MT/project	CH₄, MT/project	N₂O, MT/project	CO₂e, MT/project	CO₂e, MT/yr
Onsite Construction Equipment	115,759	5.72	0.64	116,093	15,488
Construction Worker Commuting	6,856	4.08	0.45	7,092	709
Haul Truck Trips	22,369	0.07	0.07	22,391	2,239
Total	144,984	9.87	1.16	145,575	18,437

Operating Schedule

365 days per year
10 hours per shift

Crest Raise Alternative - Shear Key Option

Table D-12. Onsite Exhaust Emissions (Includes Berm and Shear Key)

Hours per Project	Equipment Description--General	Current Equipment Model	OFFROAD Equipment	Fuel Type	Size (hp)	CO2	CH4	N2O	Unit
34,500	4" Trash pump----Operation only!	Misc. 4" Trash Pump	OFF - Light Commercial - Pumps	Gasoline	11	296.33	0.03	0.01	g/hp-hr
2,850	Crawler Mounted Hydraulic Excavator - Cat 1.25 cy bucket - 138 HP (Diesel)	Cat 320L	ConstMin - Excavators	Diesel	138	201.72	0.01	0.01	g/hp-hr
61,000	Crawler Mounted Hydraulic Excavator - Cat 5 cy bucket - 513 HP (Diesel)	Cat 385	ConstMin - Excavators	Diesel	513	201.18	0.01	0.01	g/hp-hr
130	Small Engine Generator, 1.5KW, Gas, 3.5 HP	Misc. 1.5kw generator	OFF - Light Commercial - Generator Sets	Gasoline	3.5	292.03	0.03	0.01	g/hp-hr
58	Grove 8x4x4 Truck Mounted Hyd Crane, Single Engine, 82MT, 142' Boom, 450 HP (Diesel)	Grove TMS 900	ConstMin - Cranes	Diesel	450	151.76	0.01	0.00	g/hp-hr
225	Link-Belt Rough Terrain Hyd Crane 36 MT 105' Boom, 165 HP (Diesel)	Link belt RTC 8040	ConstMin - Cranes	Diesel	165	152.26	0.01	0.00	g/hp-hr
58	Articulated Crane for Truck Mounting 105-38 (15,000# Cap.)	misc truck crane	ConstMin - Cranes	Attachment		0.00	0.00	0.00	g/hp-hr
58	Broderson 4x4 Hyd Yard Crane Diesel 28.2MT 60.7' Boom	Broderson IC-250	ConstMin - Cranes	Diesel	120	152.26	0.01	0.00	g/hp-hr
630	Cat-Te1BoomliftTrk-4Ton (10,000 lbs), TLIOSS 42'6" ft boom	CatTHS14C	ConstMin - Cranes	Attachment		0.00	0.00	0.00	g/hp-hr
79,000	6" dia Submersible Trash Pump, 3" Solids, 230 Volt (Electric)	misc. 6" pump	OFF - Light Commercial - Pumps	Electric		0.00	0.00	0.00	g/hp-hr
130	12" Gas Cut-off Saw, 4 cubic inch engine (Blade costs are not included)	misc. cut-off saw	OFF - ConstMin - Concrete/Industrial Saws	Gasoline	9	334.96	0.04	0.02	g/hp-hr
3,100	On-Highway Water Truck, 3000 Gal, 210 HP (Gas)	misc. 3000 gal water truck	n/a	Gasoline	210	43,668.23	18.42	1.99	g/hr
106,500	On-Highway Water Truck, 4000 Gal, 250 HP (Diesel)	misc. 4000 gal water truck	n/a	Diesel	250	46,261.87	0.20	0.19	g/hr
64,000	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	misc. light pickup	n/a	Gasoline	191	18,663.36	18.42	1.99	g/hr
151,500	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	misc. light pickup	n/a	Gasoline	191	18,663.36	18.42	1.99	g/hr
2,950	On-Highway Light Duty Truck/Pickup - 4X4, non, CREW, 195 HP (Diesel)	1 Ton truck	n/a	Diesel	195	20,803.21	0.20	0.19	g/hr
90,000	On-Highway Light Duty Truck/Pickup - 4X4, 3/4T, Crew, 285 HP (Gas)	Heavy duty pickup	n/a	Gasoline	285	27,449.53	18.42	1.99	g/hr
454,000	Cat Truck - Mechanical Drive Rear Dump, 55 MT, 35-46.S CY, 703 HP (Diesel)	Cat 773G	ConstMin - Off-Highway Trucks	Diesel	703	201.18	0.01	0.01	g/hp-hr
188	On-Highway Flatbed Truck, 4x2, 15k GVW, 210 HP (Gas)	misc. flatbed truck	n/a	Gasoline	210	43,668.23	18.42	1.99	g/hr
2,800	On-Highway Truck Tractor - 6X6, 70K gvw, 450 HP (Diesel)	misc. heavy duty 6x6 truck tractor	n/a	Diesel	450	65,352.42	0.20	0.19	g/hr
485	On Highway Rear Dump Truck, 8x4, 15-18 CY, 85k GVW, 450 HP (Diesel)	misc. heavy duty dump	n/a	Diesel	450	64,865.23	0.20	0.19	g/hr
158,000	Off-Highway Water Tanker, 5000 Gal, 175 HP (Diesel)	Cat 740C w/ 5000 gal water tank	ConstMin - Off-Highway Trucks	Diesel	175	201.24	0.01	0.01	g/hp-hr
450	Hand Held Rammer - 4" to 13", 3180 lb/b low, 4 HP (Gas)	misc. jumping jack	OFF - ConstMin - Tampers/Rammers	Gasoline	4	236.40	0.03	0.01	g/hp-hr
107,000	Cat 825H Pad Foot Compactor, Self Propelled, 51.6"x44.4" Front Wheel Size (Diesel)	Cat 825K	ConstMin - Rollers	Diesel	435	199.08	0.01	0.01	g/hp-hr
1,650	Cat Single Drum Self Propelled Vibratory Compactor - 84" drum Width, Padfoot 163 HP (Diesel)	Cat CP74B	ConstMin - Rollers	Diesel	163	197.86	0.01	0.01	g/hp-hr
2,850	Cat Single Drum Self Propelled Vibratory Compactor - 67" drum width, Smooth drum, 96 HP (Diesel)	Cat CP44B	ConstMin - Rollers	Diesel	96	198.12	0.01	0.01	g/hp-hr
165	Skid Steer Loader, Bobcat, 3000 lb Capacity, 81 HP (Diesel)	misc. skid steer loader	ConstMin - Skid Steer Loaders	Diesel	81	192.35	0.01	0.00	g/hp-hr
120,000	Art Frm Grader-Cat. 160M, 218 hp-EROPS	Cat 14M3	ConstMin - Graders	Diesel	218	215.88	0.01	0.01	g/hp-hr
615	Dual Engine Conventional Scraper, Cat 627G, 15.7-22cy, 365 hp, (Diesel)	Cat 623K	ConstMin - Scrapers	Diesel	365	255.00	0.01	0.01	g/hp-hr
8,400	Dual Engine Conventional Scraper, Cat, 24-34 cy, 500 HP, EROPS (Diesel)	Cat 637K	ConstMin - Scrapers	Diesel	500	255.00	0.01	0.01	g/hp-hr
2,850	4WD Articulated Wheel Loader - Cat 3.65 cy bucket - 172.0 HP - EROPS (Diesel)	Cat 938K	ConstMin - Rubber Tired Loaders	Diesel	172	190.61	0.01	0.00	g/hp-hr
260	4WD Articulated Wheel Loader - Cat 5.50 cy bucket- 262 HP - EROPS (Diesel)	Cat 966K	ConstMin - Rubber Tired Loaders	Diesel	262	190.54	0.01	0.00	g/hp-hr
20,600	4WD Articulated Wheel Loader - Cat 8.33 cy bucket- 475 HP - EROPS (Diesel)	Cat 988K	ConstMin - Rubber Tired Loaders	Diesel	475	189.91	0.01	0.00	g/hp-hr
1,270	Standard Crawler Dozer - Cat 200 hp - EROPS - Semi U (Diesel)	Cat D6T	ConstMin - Crawler Tractors	Diesel	200	226.23	0.01	0.01	g/hp-hr
116,000	Standard Crawler Dozer - Cat 310 hp - EROPS - Semi U (Diesel)	Cat D8T	ConstMin - Crawler Tractors	Diesel	310	226.49	0.01	0.01	g/hp-hr
14,500	Standard Crawler Dozer - Cat 405 hp - EROPS - Semi U (Diesel)	Cat D9T	ConstMin - Crawler Tractors	Diesel	405	226.49	0.01	0.01	g/hp-hr
1,608,772									Total

Crest Raise Alternative - Shear Key Option

Table D-12. Onsite Exhaust Emissions (Includes Berm and Shear Key)

Hours per Project	Equipment Description--General	CO2, MT/project	CH4, MT/project	N2O, MT/project	CO2e, MT/project	CO2e, MT/yr	Quantity - Day	Quantity - Night	Maximum Annual Operating Hours
34,500	4" Trash pump----Operation only!	112.46	0.00	0.00	112.63	12.10	1	0	3,650
2,850	Crawler Mounted Hydraulic Excavator - Cat 1.25 cy bucket - 138 HP (Diesel)	79.33	0.00	0.00	79.34	80.05	1	0	2,850
61,000	Crawler Mounted Hydraulic Excavator - Cat 5 cy bucket - 513 HP (Diesel)	6,295.58	0.00	0.00	6,295.69	950.24	2	1	9,125
130	Small Engine Generator, 1.5KW, Gas, 3.5 HP	0.13	0.00	0.00	0.13	0.14	1	0	130
58	Grove 8x4x4 Truck Mounted Hyd Crane, Single Engine, 82MT, 142' Boom, 450 HP (Diesel)	3.96	0.00	0.00	3.96	4.00	1	0	58
225	Link-Belt Rough Terrain Hyd Crane 36 MT 105' Boom, 165 HP (Diesel)	5.65	0.00	0.00	5.65	5.70	1	0	225
58	Articulated Crane for Truck Mounting 105-38 (15,000# Cap.)	0.00	0.00	0.00	0.00	0.00	1	0	58
58	Broderson 4x4 Hyd Yard Crane Diesel 28.2MT 60.7' Boom	1.06	0.00	0.00	1.06	1.07	1	0	58
630	Cat-Te1BoomliftTrk-4Ton (10,000 lbs), TLIOSS 42'6" ft boom	0.00	0.00	0.00	0.00	0.00	1	0	630
79,000	6" dia Submersible Trash Pump, 3" Solids, 230 Volt (Electric)	0.00	0.00	0.00	0.00	0.00	3	0	10,950
130	12" Gas Cut-off Saw, 4 cubic inch engine (Blade costs are not included)	0.39	0.00	0.00	0.39	0.40	1	0	130
3,100	On-Highway Water Truck, 3000 Gal, 210 HP (Gas)	135.37	0.06	0.01	138.64	138.64	1	0	3,100
106,500	On-Highway Water Truck, 4000 Gal, 250 HP (Diesel)	4,926.89	0.02	0.02	4,933.53	507.25	3	0	10,950
64,000	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	1,194.45	1.18	0.13	1,261.84	179.91	2	1	9,125
151,500	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	2,827.50	2.79	0.30	2,987.00	467.77	5	3	23,725
2,950	On-Highway Light Duty Truck/Pickup - 4X4, non, CREW, 195 HP (Diesel)	61.37	0.00	0.00	61.55	61.55	1	1	2,950
90,000	On-Highway Light Duty Truck/Pickup - 4X4, 3/4T, Crew, 285 HP (Gas)	2,470.46	1.66	0.18	2,565.21	364.12	3	1	12,775
454,000	Cat Truck - Mechanical Drive Rear Dump, 55 MT, 35-46.S CY, 703 HP (Diesel)	64,207.97	0.01	0.00	64,208.79	7,292.06	13	2	51,100
188	On-Highway Flatbed Truck, 4x2, 15k GVW, 210 HP (Gas)	8.21	0.00	0.00	8.41	8.41	1	0	188
2,800	On-Highway Truck Tractor - 6X6, 70K gv, 450 HP (Diesel)	182.99	0.00	0.00	183.16	183.16	1	1	2,800
485	On Highway Rear Dump Truck, 8x4, 15-18 CY, 85k GVW, 450 HP (Diesel)	31.46	0.00	0.00	31.49	31.49	1	1	485
158,000	Off-Highway Water Tanker, 5000 Gal, 175 HP (Diesel)	5,564.21	0.00	0.00	5,564.49	713.34	5	1	20,075
450	Hand Held Rammer - 4" to 13", 3180 lb/b low, 4 HP (Gas)	0.43	0.00	0.00	0.43	0.43	1	0	450
107,000	Cat 825H Pad Foot Compactor, Self Propelled, 51.6"x44.4" Front Wheel Size (Diesel)	9,266.17	0.00	0.00	9,266.37	1,116.28	3	1	12,775
1,650	Cat Single Drum Self Propelled Vibratory Compactor - 84" drum Width, Padfoot 163 HP (Diesel)	53.22	0.00	0.00	53.22	53.70	1	0	1,650
2,850	Cat Single Drum Self Propelled Vibratory Compactor - 67" drum width, Smooth drum, 96 HP (Diesel)	54.21	0.00	0.00	54.21	54.69	1	1	2,850
165	Skid Steer Loader, Bobcat, 3000 lb Capacity, 81 HP (Diesel)	2.57	0.00	0.00	2.57	2.59	1	1	165
120,000	Art Frm Grader-Cat. 160M, 218 hp-EROPS	5,647.53	0.00	0.00	5,647.76	693.31	4	0	14,600
615	Dual Engine Conventional Scraper, Cat 627G, 15.7-22cy, 365 hp, (Diesel)	57.24	0.00	0.00	57.24	57.76	1	0	615
8,400	Dual Engine Conventional Scraper, Cat, 24-34 cy, 500 HP, EROPS (Diesel)	1,070.99	0.00	0.00	1,071.01	469.57	1	0	3,650
2,850	4WD Articulated Wheel Loader - Cat 3.65 cy bucket - 172.0 HP - EROPS (Diesel)	93.44	0.00	0.00	93.44	94.28	1	0	2,850
260	4WD Articulated Wheel Loader - Cat 5.50 cy bucket- 262 HP - EROPS (Diesel)	12.98	0.00	0.00	12.98	13.10	1	0	260
20,600	4WD Articulated Wheel Loader - Cat 8.33 cy bucket- 475 HP - EROPS (Diesel)	1,858.30	0.00	0.00	1,858.34	332.23	1	0	3,650
1,270	Standard Crawler Dozer - Cat 200 hp - EROPS - Semi U (Diesel)	57.46	0.00	0.00	57.47	57.98	1	0	1,270
116,000	Standard Crawler Dozer - Cat 310 hp - EROPS - Semi U (Diesel)	8,144.51	0.00	0.00	8,144.74	1,034.32	4	0	14,600
14,500	Standard Crawler Dozer - Cat 405 hp - EROPS - Semi U (Diesel)	1,330.05	0.00	0.00	1,330.08	506.73	1	1	5,475
1,608,772		115,758.54	5.72	0.64	116,092.83	15,488.36	72	16	229,997

Conversions
1,000,000 grams per metric ton

Construction Start Year
2020

Duration
10 years

Onsite vehicle speed
40 mph

Global Warming Potential
CO2 1
CH4 25
N2O 298

Legend
On-highway engines - emission factors from EMFAC201-

Value estimated

Equipment operated during night shift

Maximum Equipment Operating
36,500 hours per project

**Crest Raise Alternative - Shear Key Option
 Offsite Exhaust Emissions**

Table D-13. Estimated Number of Truckloads

Material	Tons	Tons/ Load	Total Trips
CAS--Zone 6	1,106,280	22	50,285
<i>Stab. Berm--Zone 6</i>	<i>1,404,000</i>	<i>22</i>	<i>63,818</i>
CAS--Zone 9A	1,240,200	22	56,373
CAS--Zone 9B	1,066,320	22	48,469
<i>Zone 9B from onsite</i>	<i>(1,066,320)</i>	<i>22</i>	<i>(48,469)</i>
CAS--Pipe Bedding	1,500	22	68
<i>Stab. Berm--Pipe Bedding</i>	<i>1,700</i>	<i>22</i>	<i>77</i>
CAS--Pipe			6
<i>Stab. Berm--Pipe</i>			7
Asphalt	7,900	21	376
Demo asphalt	7,000	20	350
Mobilization			100
Demobilization			100
<i>Dispose of asbestos CMP</i>			<i>40</i>
	CAS Subtotal		156,128
	Stability Berm Subtotal		15,473
Number of Truck Loads from CAS and Stability Berm			171,601
Seeding			0
Dewatering			20
MgCl			100
Total Truck Trips (Round Trips)			171,721
Average Daily Round Trips			47

Table D-14. Annual Emissions (metric tons per year)

Source	CO2, g/mi	CH4, g/mi	N2O, g/mi	CO2, MT/yr	CH4, MT/yr	N2O, MT/yr	CO2e, MT/yr
Construction workers	308.94	0.1838	0.0202	685.61	0.41	0.04	709.17
Haul trucks	1,628.32	0.0051	0.0048	2,236.94	0.01	0.01	2,239.08
Total	n/a	n/a	n/a	2,922.55	0.41	0.05	2,948.24

One-way trip distance

Workers 40 miles per trip
 Trucks 40 miles per trip

Maximum Daily Workers

76 workers per day
 (46 for day shift; 30 for night shift)

Conversions

1,000,000 grams per metric ton

Operating Schedule

365 days per year
 10 years

Global Warming Potential

CO2 1
 CH4 25
 N2O 298

CH4 and N2O Emission Factors

Table D-15. San Joaquin Valley Emission Factors

Year	Type	Fuel	VMT	CH4 (g/mi)	N2O (g/mi)
2020	LDA	GAS	51,905,504	0.1780	0.0197
		DSL	526,303	0.0006	0.0012
	LDT	GAS	21,727,734	0.2024	0.0220
		DSL	35,164	0.0011	0.0017
Weighted Average Emission Factor				0.1838	0.0202

Table D-16. Emission Factors for Highway Vehicles by Technology Type

Vehicle Type/Control Technology	CH4 (g/mi)	N2O (g/mi)
Gasoline Passenger Cars		
EPA Tier 2	0.0173	0.0036
Low Emission Vehicles	0.0105	0.0150
EPA Tier 1	0.0271	0.0429
EPA Tier 0	0.0704	0.0647
Oxidation Catalyst	0.1355	0.0504
Non-Catalyst Control	0.1696	0.0197
Uncontrolled	0.1780	0.0197
Gasoline Light Trucks (Vans, Pickup Trucks, SUVs)		
EPA Tier 2	0.0163	0.0066
Low Emission Vehicles	0.0148	0.0157
EPA Tier 1	0.0452	0.0871
EPA Tier 0	0.0776	0.1056
Oxidation Catalyst	0.1516	0.0639
Non-Catalyst Control	0.1908	0.0218
Uncontrolled	0.2024	0.0220
Gasoline Medium and Heavy-Duty Vehicles Trucks and Busses		
EPA Tier 2	0.0333	0.0134
Low Emission Vehicles	0.0303	0.0320
EPA Tier 1	0.0655	0.1750
EPA Tier 0	0.2630	0.2135
Oxidation Catalyst	0.2356	0.1317
Non-Catalyst Control	0.4181	0.0473
Uncontrolled	0.4604	0.0497
Diesel Passenger Cars		
Advanced	0.0005	0.0010
Moderate	0.0005	0.0010
Uncontrolled	0.0006	0.0012
Diesel Light Trucks		
Advanced	0.0010	0.0015
Moderate	0.0009	0.0014
Uncontrolled	0.0011	0.0017
Diesel Medium and Heavy-Duty Vehicles (Trucks and Busses)		
Aftertreatment	0.0051	0.0048
Advanced	0.0051	0.0048
Moderate	0.0051	0.0048
Uncontrolled	0.0051	0.0048
Motorcycles		
Non-Catalyst Control	0.0672	0.0069
Uncontrolled	0.0899	0.0087

Source: The Climate Registry. 2018. The Climate Registry 2018 Default Emission Factor Document.

Table D-17. Emission Factors from Non-Highway Vehicles

Vehicle Type / Fuel Type	CH4 (g/gallon)	N2O (g/gallon)
Ships and Boats		
Residual Fuel Oil	0.11	0.60
Diesel Fuel	0.06	0.45
Gasoline	0.64	0.22
Locomotives		
Diesel Fuel	0.80	0.26
Agricultural Equipment		
Gasoline	1.26	0.22
Diesel Fuel	1.44	0.26
Construction/Mining Equipment		
Gasoline	0.50	0.22
Diesel Fuel	0.58	0.26
Other Non-Highway		
Snowmobiles (Gasoline)	0.50	0.22
Other Recreational (Gasoline)	0.50	0.22
Other Small Utility (Gasoline)	0.50	0.22
Other Large Utility (Gasoline)	0.50	0.22
Other Large Utility (Diesel)	0.58	0.26
Aircraft		
Jet Fuel		0.31
Aviation Gasoline	7.05	0.11

Source: The Climate Registry. 2018. The Climate Registry 2018 Default Emission Factor Document.

Crest Raise Alternative - No Shear Key

Table D-17. Unmitigated Annual Emissions Summary

Source	CO₂, MT/project	CH₄, MT/project	N₂O, MT/project	CO₂e, MT/project	CO₂e, MT/yr
Onsite Construction Equipment	73,571	4.72	0.53	73,846	13,405
Construction Worker Commuting	5,485	3.26	0.36	5,673	709
Haul Truck Trips	22,369	0.07	0.07	22,391	2,799
Total	101,426	8.05	0.95	101,910	16,913

Operating Schedule

365 days per year
10 hours per shift

Crest Raise Alternative - No Shear Key

Table D-18. Onsite Exhaust Emissions (No Shear Key)

Hours per Project	Equipment Description--General	Current Equipment Model	OFFROAD Equipment	Fuel Type	Size (hp)	CO2	CH4	N2O	Unit
34,500	4" Trash pump-----Operation only!	Misc. 4" Trash Pump	OFF - Light Commercial - Pumps	Gasoline	11	296.33	0.03	0.01	g/hp-hr
2,850	Crawler Mounted Hydraulic Excavator - Cat 1.25 cy bucket - 138 HP (Diesel)	Cat 320L	ConstMin - Excavators	Diesel	138	201.72	0.01	0.01	g/hp-hr
34,000	Crawler Mounted Hydraulic Excavator - Cat 5 cy bucket- 513 HP (Diesel)	Cat 385	ConstMin - Excavators	Diesel	513	201.18	0.01	0.01	g/hp-hr
130	Small Engine Generator, 1.5KW, Gas, 3.5 HP	Misc. 1.5kw generator	OFF - Light Commercial - Generator Sets	Gasoline	3.5	292.03	0.03	0.01	g/hp-hr
58	Grove 8x4x4 Truck Mounted Hyd Crane, Single Engine, 82MT, 142' Boom, 450 HP (Diesel)	Grove TMS 900	ConstMin - Cranes	Diesel	450	151.76	0.01	0.00	g/hp-hr
225	Link-Belt Rough Terrain Hyd Crane 36 MT 105' Boom, 165 HP (Diesel)	Link belt RTC 8040	ConstMin - Cranes	Diesel	165	152.26	0.01	0.00	g/hp-hr
58	Articulated Crane for Truck Mounting 105-38 {15,000# Cap.)	misc truck crane	ConstMin - Cranes	Attachment		0.00	0.00	0.00	g/hp-hr
58	Broderson 4x4 Hyd Yard Crane Diesel 28.2MT 60.7' Boom	Broderson IC-250	ConstMin - Cranes	Diesel	120	152.26	0.01	0.00	g/hp-hr
630	Cat-TelBoomiLiftTrk-4Ton {10,000 lbs), T11055 42'6" ft boom	CatTH514C	ConstMin - Cranes	Attachment		0.00	0.00	0.00	g/hp-hr
52,000	6" dia Submersible Trash Pump, 3" Solids, 230 Volt (Electric)	misc. 6" pump	OFF - Light Commercial - Pumps	Electric		0.00	0.00	0.00	g/hp-hr
130	12" Gas Cut-off Saw, 4 cubic inch engine (Blade costs are not included)	misc. cut-off saw	OFF - ConstMin - Concrete/Industrial Saws	Gasoline	9	334.96	0.04	0.02	g/hp-hr
3,100	On-Highway Water Truck, 3000 Gal, 210 HP (Gas)	misc. 3000 gal water truck	n/a	Gasoline	210	43,668.23	18.42	1.99	g/hr
76,200	On-Highway Water Truck, 4000 Gal, 250 HP (Diesel)	misc. 4000 gal water truck	n/a	Diesel	250	46,261.87	0.20	0.19	g/hr
37,000	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	misc. light pickup	n/a	Gasoline	191	18,663.36	18.42	1.99	g/hr
151,500	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	misc. light pickup	n/a	Gasoline	191	18,663.36	18.42	1.99	g/hr
2,950	On-Highway Light Duty Truck/Pickup- 4X4, IT on , CREW, 195 HP (Diesel)	1 Ton truck	n/a	Diesel	195	20,803.21	0.20	0.19	g/hr
63,000	On-Highway Light Duty Truck/Pickup - 4X4, 3/4T, Crew, 285 HP (Gas)	Heavy duty pickup	n/a	Gasoline	285	27,449.53	18.42	1.99	g/hr
293,000	Cat Truck- Mechanical Drive Rear Dump, 55 MT, 35-46.5 CY, 703 HP (Diesel)	Cat 773G	ConstMin - Off-Highway Trucks	Diesel	703	201.18	0.01	0.01	g/hp-hr
188	On-Highway Flatbed Truck, 4x2, 15k GVW, 210 HP (Gas)	misc . flatbed truck	n/a	Gasoline	210	43,668.23	18.42	1.99	g/hr
2,800	On-Highway Truck Tractor - 6X6, 70K gvw, 450 HP (Diesel)	misc. heavy duty 6x6 truck tractor	n/a	Diesel	450	65,352.42	0.20	0.19	g/hr
485	On Highway Rear Dump Truck, 8x4, 15-18 CV, 85k GVW, 450 HP (Diesel)	misc. heavy duty dump	n/a	Diesel	450	64,865.23	0.20	0.19	g/hr
76,200	Off-Highway Water Tanker, 5000 Gal, 175 HP (Diesel)	Cat 740C w/ 5000 gal water tank	ConstMin - Off-Highway Trucks	Diesel	175	201.24	0.01	0.01	g/hp-hr
450	Hand Held Rammer - 4" to13", 3180 lb/blow, 4 HP (Gas)	misc. jumping jack	OFF - ConstMin - Tampers/Rammers	Gasoline	4	236.40	0.03	0.01	g/hp-hr
53,000	Cat 825H Pad Foot Compactor, Self Propelled, 51.6"x44.4" Front Wheel Size (Diesel)	Cat 825K	ConstMin - Rollers	Diesel	435	199.08	0.01	0.01	g/hp-hr
1,650	Cat Single Drum Self Propelled Vibratory Compactor - 84" drum Width, Padfoot 163 HP (Diesel)	Cat CP74B	ConstMin - Rollers	Diesel	163	197.86	0.01	0.01	g/hp-hr
2,850	Cat Single Drum Self Propelled Vibratory Compactor - 67" drum width, Smooth drum, 96 HP (Diesel)	Cat CP44B	ConstMin - Rollers	Diesel	96	198.12	0.01	0.01	g/hp-hr
165	Skid Steer Loader, Bobcat, 3000 lb Capacity, 81 HP (Diesel)	misc. skid steer loader	ConstMin - Skid Steer Loaders	Diesel	81	192.35	0.01	0.00	g/hp-hr
64,000	Art Frm Grader-Cat. 160M, 218 hp-EROPS	Cat 14M3	ConstMin - Graders	Diesel	218	215.88	0.01	0.01	g/hp-hr
615	Dual Engine Conventional Scraper , Cat 627G, 15.7-22cy , 365 hp, (Diesel)	Cat 623K	ConstMin - Scrapers	Diesel	365	255.00	0.01	0.01	g/hp-hr
8,400	Dual Engine Conventional Scraper, Cat, 24-34 cy, 500 HP, EROPS (Diesel)	Cat 637K	ConstMin - Scrapers	Diesel	500	255.00	0.01	0.01	g/hp-hr
2,850	4WD Articulated Wheel Loader - Cat 3.65 cy bucket - 172.0 HP - EROPS (Diesel)	Cat 938K	ConstMin - Rubber Tired Loaders	Diesel	172	190.61	0.01	0.00	g/hp-hr
260	4WD Articulated Wheel Loader - Cat 5.50 cy bucket - 262 HP - EROPS (Diesel)	Cat 966K	ConstMin - Rubber Tired Loaders	Diesel	262	190.54	0.01	0.00	g/hp-hr
20,600	4WD Articulated Wheel Loader - Cat 8.33 cy bucket - 475 HP - EROPS (Diesel)	Cat 988K	ConstMin - Rubber Tired Loaders	Diesel	475	189.91	0.01	0.00	g/hp-hr
1,270	Standard Crawler Dozer - Cat 200 hp - EROPS - Semi U (Diesel)	Cat D6T	ConstMin - Crawler Tractors	Diesel	200	226.23	0.01	0.01	g/hp-hr
62,000	Standard Crawler Dozer - Cat 310 hp - EROPS - Semi U (Diesel)	Cat D8T	ConstMin - Crawler Tractors	Diesel	310	226.49	0.01	0.01	g/hp-hr
14,500	Standard Crawler Dozer - Cat 405 hp - EROPS - Semi U (Diesel)	Cat D9T	ConstMin - Crawler Tractors	Diesel	405	226.49	0.01	0.01	g/hp-hr
1,063,672									Total

Crest Raise Alternative - No Shear Key

Table D-18. Onsite Exhaust Emissions (No Shear Key)

Hours per Project	Equipment Description--General	CO2, MT/project	CH4, MT/project	N2O, MT/project	CO2e, MT/project	CO2e, MT/yr	Quantity - Day	Quantity - Night	Maximum Annual Operating Hours
34,500	4" Trash pump----Operation only!	112.46	0.00	0.00	112.63	24.20	2	0	7,300
2,850	Crawler Mounted Hydraulic Excavator - Cat 1.25 cy bucket - 138 HP (Diesel)	79.33	0.00	0.00	79.34	80.05	1	0	2,850
34,000	Crawler Mounted Hydraulic Excavator - Cat 5 cy bucket- 513 HP (Diesel)	3,509.01	0.00	0.00	3,509.07	1,140.29	2	2	10,950
130	Small Engine Generator, 1.5KW, Gas, 3.5 HP	0.13	0.00	0.00	0.13	0.14	1	0	130
58	Grove 8x4x4 Truck Mounted Hyd Crane, Single Engine, 82MT, 142' Boom, 450 HP (Diesel)	3.96	0.00	0.00	3.96	4.00	1	0	58
225	Link-Belt Rough Terrain Hyd Crane 36 MT 105' Boom, 165 HP (Diesel)	5.65	0.00	0.00	5.65	5.70	1	0	225
58	Articulated Crane for Truck Mounting 105-38 {15,000# Cap.}	0.00	0.00	0.00	0.00	0.00	1	0	58
58	Broderson 4x4 Hyd Yard Crane Diesel 28.2MT 60.7' Boom	1.06	0.00	0.00	1.06	1.07	1	0	58
630	Cat-TelBoomiiftTrk-4Ton {10,000 lbs), T11055 42'6" ft boom	0.00	0.00	0.00	0.00	0.00	1	0	630
52,000	6" dia Submersible Trash Pump, 3" Solids, 230 Volt (Electric)	0.00	0.00	0.00	0.00	0.00	2	0	7,300
130	12" Gas Cut-off Saw, 4 cubic inch engine (Blade costs are not included)	0.39	0.00	0.00	0.39	0.40	1	0	130
3,100	On-Highway Water Truck, 3000 Gal, 210 HP (Gas)	135.37	0.06	0.01	138.64	138.64	1	0	3,100
76,200	On-Highway Water Truck, 4000 Gal, 250 HP (Diesel)	3,525.15	0.02	0.01	3,529.90	507.25	3	0	10,950
37,000	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	690.54	0.68	0.07	729.50	215.89	2	2	10,950
151,500	On-Highway Light Duty Truck/Pickup - 4X4, 1/2T, Conventional, 191 HP (Gas)	2,827.50	2.79	0.30	2,987.00	539.73	6	3	27,375
2,950	On-Highway Light Duty Truck/Pickup- 4X4, IT on , CREW, 195 HP (Diesel)	61.37	0.00	0.00	61.55	61.55	1	1	2,950
63,000	On-Highway Light Duty Truck/Pickup - 4X4, 3/4T, Crew, 285 HP (Gas)	1,729.32	1.16	0.13	1,795.65	416.13	3	2	14,600
293,000	Cat Truck- Mechanical Drive Rear Dump, 55 MT, 35-46.5 CY, 703 HP (Diesel)	41,438.18	0.00	0.00	41,438.71	6,250.34	11	2	43,800
188	On-Highway Flatbed Truck, 4x2, 15k GVW, 210 HP (Gas)	8.21	0.00	0.00	8.41	8.41	1	0	188
2,800	On-Highway Truck Tractor - 6X6, 70K gvw, 450 HP (Diesel)	182.99	0.00	0.00	183.16	183.16	1	0	2,800
485	On Highway Rear Dump Truck, 8x4, 15-18 CV, 85k GVW, 450 HP (Diesel)	31.46	0.00	0.00	31.49	31.49	1	0	485
76,200	Off-Highway Water Tanker, 5000 Gal, 175 HP (Diesel)	2,683.50	0.00	0.00	2,683.64	389.10	3	0	10,950
450	Hand Held Rammer - 4" to13", 3180 lb/blow, 4 HP (Gas)	0.43	0.00	0.00	0.43	0.43	1	0	450
53,000	Cat 825H Pad Foot Compactor, Self Propelled, 51.6"x44.4" Front Wheel Size (Diesel)	4,589.79	0.00	0.00	4,589.88	637.88	2	0	7,300
1,650	Cat Single Drum Self Propelled Vibratory Compactor - 84" drum Width, Padfoot 163 HP (Diesel)	53.22	0.00	0.00	53.22	53.70	1	0	1,650
2,850	Cat Single Drum Self Propelled Vibratory Compactor - 67" drum width, Smooth drum, 96 HP (Diesel)	54.21	0.00	0.00	54.21	54.69	1	1	2,850
165	Skid Steer Loader, Bobcat, 3000 lb Capacity, 81 HP (Diesel)	2.57	0.00	0.00	2.57	2.59	1	1	165
64,000	Art Frm Grader-Cat. 160M, 218 hp-EROPS	3,012.01	0.00	0.00	3,012.14	519.98	3	0	10,950
615	Dual Engine Conventional Scraper , Cat 627G, 15.7-22cy , 365 hp, (Diesel)	57.24	0.00	0.00	57.24	57.76	1	0	615
8,400	Dual Engine Conventional Scraper, Cat, 24-34 cy, 500 HP, EROPS (Diesel)	1,070.99	0.00	0.00	1,071.01	469.57	1	0	3,650
2,850	4WD Articulated Wheel Loader - Cat 3.65 cy bucket - 172.0 HP - EROPS (Diesel)	93.44	0.00	0.00	93.44	94.28	1	0	2,850
260	4WD Articulated Wheel Loader - Cat 5.50 cy bucket - 262 HP - EROPS (Diesel)	12.98	0.00	0.00	12.98	13.10	1	0	260
20,600	4WD Articulated Wheel Loader - Cat 8.33 cy bucket - 475 HP - EROPS (Diesel)	1,858.30	0.00	0.00	1,858.34	332.23	1	0	3,650
1,270	Standard Crawler Dozer - Cat 200 hp - EROPS - Semi U (Diesel)	57.46	0.00	0.00	57.47	57.98	1	0	1,270
62,000	Standard Crawler Dozer - Cat 310 hp - EROPS - Semi U (Diesel)	4,353.10	0.00	0.00	4,353.22	775.74	3	0	10,950
14,500	Standard Crawler Dozer - Cat 405 hp - EROPS - Semi U (Diesel)	1,330.05	0.00	0.00	1,330.08	337.82	1	0	3,650
1,063,672		73,571.38	4.72	0.53	73,846.13	13,405.28	66	14	208,097

Conversions
1,000,000 grams per metric ton

Construction Start Year
2020

Duration
8 years

Onsite vehicle speed
40 mph

Global Warming Potential
CO2 1
CH4 25
N2O 298

Legend
On-highway engines - emission factors from EMFAC2014
Value estimated
Equipment operated during night shift

Maximum Equipment Operating
29,200 hours per project

**Crest Raise Alternative - No Shear Key
 Offsite Exhaust Emissions**

Table D-19. Estimated Number of Truckloads

Material	Tons	Tons/ Load	Total Trips
CAS--Zone 6	1,106,280	22	50,285
<i>Stab. Berm--Zone 6</i>	<i>1,404,000</i>	<i>22</i>	<i>63,818</i>
CAS--Zone 9A	1,240,200	22	56,373
CAS--Zone 9B	1,066,320	22	48,469
<i>Zone 9B from onsite</i>	<i>(1,066,320)</i>	<i>22</i>	<i>(48,469)</i>
CAS--Pipe Bedding	1,500	22	68
<i>Stab. Berm--Pipe Bedding</i>	<i>1,700</i>	<i>22</i>	<i>77</i>
CAS--Pipe			6
<i>Stab. Berm--Pipe</i>			<i>7</i>
Asphalt	7,900	21	376
Demo asphalt	7,000	20	350
Mobilization			100
Demobilization			100
<i>Dispose of asbestos CMP</i>			<i>40</i>
	CAS Subtotal		156,128
	Stability Berm Subtotal		15,473
Number of Truck Loads from CAS and Stability Berm			171,601
Seeding			0
Dewatering			20
MgCl			100
Total Truck Trips (Round Trips)			171,721
Average Daily Round Trips			59

Table D-20. Annual Emissions (metric tons per year)

Source	CO ₂ , g/mi	CH ₄ , g/mi	N ₂ O, g/mi	CO ₂ , MT/yr	CH ₄ , MT/yr	N ₂ O, MT/yr	CO ₂ e, MT/yr
Construction workers	308.94	0.1838	0.0202	685.61	0.41	0.04	709.17
Haul trucks	1,628.32	0.0051	0.0048	2,796.17	0.01	0.01	2,798.85
Total	n/a	n/a	n/a	3,481.78	0.42	0.05	3,508.01

One-way trip distance

Workers 40 miles per trip
 Trucks 40 miles per trip

Maximum Daily Workers

76 workers per day
 (46 for day shift; 30 for night shift)

Conversions

1,000,000 grams per metric ton

Operating Schedule

365 days per year
 8 years

Global Warming Potential

CO₂ 1
 CH₄ 25
 N₂O 298

CH4 and N2O Emission Factors

Table D-21. San Joaquin Valley Emission Factors

Year	Type	Fuel	VMT	CH4 (g/mi)	N2O (g/mi)
2020	LDA	GAS	51,905,504	0.1780	0.0197
		DSL	526,303	0.0006	0.0012
	LDT	GAS	21,727,734	0.2024	0.0220
		DSL	35,164	0.0011	0.0017
Weighted Average Emission Factor				0.1838	0.0202

Table D-22. Emission Factors for Highway Vehicles by Technology Type

Vehicle Type/Control Technology	CH4 (g/mi)	N2O (g/mi)
Gasoline Passenger Cars		
EPA Tier 2	0.0173	0.0036
Low Emission Vehicles	0.0105	0.0150
EPA Tier 1	0.0271	0.0429
EPA Tier 0	0.0704	0.0647
Oxidation Catalyst	0.1355	0.0504
Non-Catalyst Control	0.1696	0.0197
Uncontrolled	0.1780	0.0197
Gasoline Light Trucks (Vans, Pickup Trucks, SUVs)		
EPA Tier 2	0.0163	0.0066
Low Emission Vehicles	0.0148	0.0157
EPA Tier 1	0.0452	0.0871
EPA Tier 0	0.0776	0.1056
Oxidation Catalyst	0.1516	0.0639
Non-Catalyst Control	0.1908	0.0218
Uncontrolled	0.2024	0.0220
Gasoline Medium and Heavy-Duty Vehicles Trucks and Busses		
EPA Tier 2	0.0333	0.0134
Low Emission Vehicles	0.0303	0.0320
EPA Tier 1	0.0655	0.1750
EPA Tier 0	0.2630	0.2135
Oxidation Catalyst	0.2356	0.1317
Non-Catalyst Control	0.4181	0.0473
Uncontrolled	0.4604	0.0497
Diesel Passenger Cars		
Advanced	0.0005	0.0010
Moderate	0.0005	0.0010
Uncontrolled	0.0006	0.0012
Diesel Light Trucks		
Advanced	0.0010	0.0015
Moderate	0.0009	0.0014
Uncontrolled	0.0011	0.0017
Diesel Medium and Heavy-Duty Vehicles (Trucks and Busses)		
Aftertreatment	0.0051	0.0048
Advanced	0.0051	0.0048
Moderate	0.0051	0.0048
Uncontrolled	0.0051	0.0048
Motorcycles		
Non-Catalyst Control	0.0672	0.0069
Uncontrolled	0.0899	0.0087

Source: The Climate Registry. 2018. The Climate Registry 2018 Default Emission Factor Document.

Table D-23. Emission Factors from Non-Highway Vehicles

Vehicle Type / Fuel Type	CH4 (g/gallon)	N2O (g/gallon)
Ships and Boats		
Residual Fuel Oil	0.11	0.60
Diesel Fuel	0.06	0.45
Gasoline	0.64	0.22
Locomotives		
Diesel Fuel	0.80	0.26
Agricultural Equipment		
Gasoline	1.26	0.22
Diesel Fuel	1.44	0.26
Construction/Mining Equipment		
Gasoline	0.50	0.22
Diesel Fuel	0.58	0.26
Other Non-Highway		
Snowmobiles (Gasoline)	0.50	0.22
Other Recreational (Gasoline)	0.50	0.22
Other Small Utility (Gasoline)	0.50	0.22
Other Large Utility (Gasoline)	0.50	0.22
Other Large Utility (Diesel)	0.58	0.26
Aircraft		
Jet Fuel		0.31
Aviation Gasoline	7.05	0.11

Source: The Climate Registry. 2018. The Climate Registry 2018 Default Emission Factor Document.