Appendix G

Air Emission Calculations

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TAB A. CONSTRUCTION SUMMARY

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 200	0.51	2.44	5.48	0.12	5.02	0.86	532
Area 300	0.45	1.95	6.11	0.14	55.05	5.81	641
Area 400 - land	0.07	0.09	0.22	0.00	0.17	0.03	21
Area 400 - water	0.53	4.90	9.58	1.04	0.42	0.41	1,180
Area 500	0.01	0.02	0.07	0.00	0.88	0.09	6
Area 600	0.01	0.05	0.11	0.00	0.09	0.02	11
Rail Infrastructure	0.01	0.05	0.19	0.00	3.79	0.39	21
Materials Transport	0.62	3.27	14.86	0.01	0.63	0.61	1500
POVs	0.37	10.75	1.51	0.00	0.06	0.06	116
Total	**2.57**	**23.52**	**38.12**	**1.33**	**66.12**	**8.26**	**4,028**

TAB B. CONSTRUCTION EMISSIONS - AREA 200

Basic Conversions

453.59 grams per pound
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4
0.26 g/gal N2O

Table 1. Clearing 1.0 Acres

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	11	145	0.58	0.38	1.41	4.17	0.12	0.30	0.29	0.01	0.03	536	0.052
Loader	11	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	0.02	0.04	692	0.068
Small backhoe	11	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	0.02	0.04	692	0.068

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	5	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
0.77	2.88	8.51	0.24	0.60	0.59	0.03	0.06	1,093
0.63	3.26	2.81	0.07	0.47	0.46	0.01	0.02	307
0.40	2.06	1.78	0.04	0.30	0.29	0.00	0.01	194
VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
0.08	0.42	1.89	0.00	0.08	0.08	0.00	0.00	172
Subtotal (lbs):	**2**	**9**	**15**	**0**	**1**	**1**	**0**	**0**	**1,766**

Table 2. Excavate/Fill - Grading

Site Prep - Excavate/Fill

(CY) 16,075 CY

Grading (SY) 24,286 SY Assume compact 0.5 feet (0.166 yards) 4,032 CY compacted

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Backhoe Excavator	54	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	0.01	0.03	536	0.052
Skid Steer Loader	63	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
Dozer	58	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	0.01	0.03	536	0.052
Compactor	30	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052
Grader	9	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (14 CY)	54	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

dump truck operations onsite only	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	5.87	20.64	68.78	1.97	3.80	3.69	0.23	0.51	9,149
	1.96	7.51	22.17	0.59	1.56	1.51	0.07	0.15	2,740
	4.12	15.47	45.65	1.26	3.24	3.14	0.15	0.33	5,863
	1.55	6.18	17.96	0.45	1.26	1.22	0.05	0.12	2,108
	1.13	3.96	13.35	0.38	0.74	0.72	0.04	0.10	1,758
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb
	0.86	4.49	20.44	0.01	0.86	0.84	0.01	0.01	1,857
Subtotal (lbs):	**15**	**58**	**188**	**5**	**11**	**11**	**1**	**1**	**23,475**

Table 3. Gravel Work 3,734 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	37	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	0.01	0.03	536	0.052
Wheel Loader	47	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Compactor	103	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC[3] lb/mile	CO[3] lb/mile	NOx[3] lb/mile	SO_2[3] lb/mile	PM10[3] lb/mile	PM2.5[3] lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (onsite)	44	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

Dump truck time based on 10 minutes onsite to arrive, dump, depart.	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	3.06	10.75	36.33	1.03	2.01	1.95	0.12	0.27	4,772
	1.85	6.64	22.52	0.61	1.27	1.23	0.07	0.16	2,851
	3.62	13.46	44.77	1.16	2.59	2.51	0.14	0.30	5,391
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb
	0.71	3.70	16.83	0.01	0.71	0.69	0.00	0.00	1,529
Subtotal (lbs):	**9**	**35**	**120**	**3**	**7**	**6**	**0**	**1**	**14,543**

Table 4. Foundations and other Concrete Work Total Concrete 3,972 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Concrete Mixers	209	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	0.01	0.03	588	0.058
Concrete Truck	189	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	0.01	0.03	539	0.053

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	0.48	2.11	4.28	0.09	0.37	0.36	0.01	0.02	408
	20.40	93.84	332.31	6.13	14.44	14.01	0.74	1.62	28,972
Subtotal (lbs):	**21**	**96**	**337**	**6**	**15**	**14**	**1**	**2**	**29,380**

Table 5. Building Construction 15,900 SF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Crane	80	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	0.01	0.03	530	0.052
Concrete truck	80	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	0.01	0.03	536	0.052
Diesel Generator	64	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	0.01	0.03	536	0.052
Telehandler	159	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Scissors Lift	127	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Skid Steer Loader	80	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	0.02	0.04	691	0.068
All Terrain Forklift	3	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
				8.29	41.17	177.56	3.85	7.01	6.80	0.46	1.00	17891	
				4.27	33.09	98.30	2.62	4.78	4.64	0.31	0.68	12195	
				0.64	3.42	8.51	0.26	0.56	0.55	0.03	0.07	1301	
			Subtotal (lbs):	**13**	**78**	**284**	**7**	**12**	**12**	**1**	**2**	**31,387**	

Table 6. Building Construction (Rail Unloading Facilit 168,350 SF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Crane	1,010	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	0.01	0.03	530	0.052
Diesel Generator	5,408	40	0.43	0.43	1.94	4.94	0.13	0.46	0.45	0.01	0.03	589	0.058
Telehandler	1,684	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Scissors Lift	1,347	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Skid steer loader	842	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	0.02	0.04	691	0.068
Pile Driver	1,467	260	0.43	0.46	1.55	5.90	0.11	0.31	0.30	0.01	0.03	530	0.052
All Terrain Forklift	831	85	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
On-road Equipment	**Hours of Operation**	**Engine HP**	**Speed (mph)**	**VOC** lb/mile	**CO** lb/mile	**NOx** lb/mile	**SO2** lb/mile	**PM10** lb/mile	**PM2.5** lb/mile	**N2O** lb/mile	**CH4** lb/mile	**CO2** lb/mile	
Concrete truck	197	300	0.43	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.56E-03	0.00001	1.124E-05	3.439	
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
				104.71	519.74	2241.65	48.62	88.53	85.87	5.75	12.61	225879	
				87.89	397.65	1013.07	25.99	94.51	91.68	3.08	6.74	120786	
				110.50	854.34	1068.86	27.74	113.01	109.62	3.29	7.20	129028	
				74.10	572.93	716.79	18.60	75.78	73.51	2.20	4.83	86527	
				124.19	584.67	491.49	10.90	87.26	84.64	1.29	2.83	50705	
				167.81	561.19	2134.34	41.20	113.50	110.10	4.88	10.70	191665	
				46.82	361.97	452.86	11.75	47.88	46.44	1.39	3.05	54667	
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
				0.13	0.70	3.20	0.00	0.14	0.13	0.00	0.00	291	
			Subtotal (lbs):	**716**	**3,853**	**8,122**	**185**	**621**	**602**	**22**	**48**	**859,548**	

Table 7. Paving Pavement - Surface Area 81,600 SF 1,304 CY
Paving - HMA 35,206 CF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Grader	250	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	0.01	0.03	536	0.052
Roller	375	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	0.01	0.03	536	0.052
Paving Machine	500	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	0.01	0.03	536	0.052
Asphalt Curbing Machine	50	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	301	230	10	0.002	0.008	0.038	0.000	0.002	0.002	0.00001	1.124E-05	3.439
Water Truck	8	230	10	0.002	0.008	0.038	0.000	0.002	0.002	0.00001	1.124E-05	3.439

Hot Mix Asphalt (HMA)	Volume of HMA (ft^3)	Weight of HMA (tons)	VOC[3] lb/ton of asphalt	CO lb/ton of asphalt	Nox lb/ton of asphalt	SO_2 lb/ton of asphalt	PM10 lb/ton of asphalt	PM2.5 lb/ton of asphalt
	35,206	2,552	0.04	-	-	-	-	-

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
17.75	66.58	196.21	5.43	13.94	13.52	0.64	1.41	25,273
66.77	481.72	1,082.61	22.54	66.25	64.26	2.67	5.85	104,840
40.53	153.86	453.53	12.29	32.00	31.04	1.46	3.19	57,170
3.34	13.28	38.60	0.97	2.70	2.62	0.12	0.25	4,532

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
4.78	25.03	113.92	0.05	4.82	4.68	0.03	0.03	10,350
0.13	0.67	3.03	0.00	0.13	0.12	0.00	0.00	275

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
102.10	-	-	-	-	-	-	-	-
235	**741**	**1,888**	**41**	**120**	**116**	**5**	**11**	**202,440**

Subtotal (lbs):

Table 8. Fugitive Dust

PM_{10} tons/acre/mo	acres	days	PM_{10} Tons	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ Tons
0.42	7.6	29	4.6	0.1	0.5

Table 9. Construction Summary

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 200	0.51	2.44	5.48	0.12	5.02	0.86	532

TAB C. CONSTRUCTION EMISSIONS - AREA 300

Basic Conversions

453.59 grams per pound
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4
0.26 g/gal N2O

Table 1. Excavate/Fill - Grading

Site Prep - Excavate/Fill (CY) 286,060 CY
Grading (SY) 100,866 SY ,ssume compact 0.5 feet (0.166 yards) 16,744 CY compacted

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Backhoe Excavator	954	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	0.01	0.03	536	0.052
Skid Steer Loader	1,144	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
Dozer	1,036	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	0.01	0.03	536	0.052
Compactor	78	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052
Grader	36	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (14 CY)	954	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
103.70	364.63	1,215.05	34.75	67.18	65.17	4.12	9.02	161,625
35.57	136.43	402.66	10.69	28.34	27.49	1.27	2.78	49,748
73.60	276.35	815.49	22.52	57.83	56.10	2.67	5.85	104,732
4.06	16.13	46.90	1.18	3.28	3.18	0.14	0.31	5,506
4.51	15.85	53.40	1.51	2.96	2.87	0.18	0.39	7,032
VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
15.16	79.32	361.07	0.17	15.26	14.84	0.10	0.11	32,804
237	**889**	**2,895**	**71**	**175**	**170**	**8**	**18**	**361,447**

Subtotal (lbs):

Table 2. Gravel Work 87,601 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	876	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	0.01	0.03	536	0.052
Wheel Loader	1,095	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Compactor	2,416	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC[3] lb/mile	CO[3] lb/mile	NOx[3] lb/mile	SO_2[3] lb/mile	PM10[3] lb/mile	PM2.5[3] lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (onsite)	1,043	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

Dump truck time based on 10 minutes onsite to arrive, dump, depart.

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
72.46	254.50	860.09	24.29	47.66	46.23	2.88	6.31	112,987
43.21	154.68	524.57	14.28	29.58	28.69	1.69	3.71	66,418
84.83	315.82	1,050.18	27.19	60.65	58.83	3.22	7.06	126,446
VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
16.57	86.71	394.70	0.19	16.69	16.22	0.11	0.12	35,859.47
217	**812**	**2,830**	**66**	**155**	**150**	**8**	**17**	**341,710**

Subtotal (lbs):

Table 3. Foundations and other Concrete Work Total Concrete 1,000 CY

Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Concrete Mixers	53	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	0.01	0.03	588	0.058
Concrete Truck	48	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	0.01	0.03	539	0.053
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
				0.12	0.54	1.09	0.02	0.10	0.09	0.00	0.01	103	
				5.18	23.83	84.40	1.56	3.67	3.56	0.19	0.41	7,358	
			Subtotal (lbs):	**5**	**24**	**85**	**2**	**4**	**4**	**0**	**0**	**7,461**	

Table 4. Building and Tank Construction 3,270 SF buildings

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Crane	1,823	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	0.01	0.03	530	0.052
Wheel Loader	83	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Concrete truck	16	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	0.01	0.03	536	0.052
Diesel Generator	263	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	0.01	0.03	536	0.052
Telehandler	283	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Scissors Lift	276	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Skid Steer Loader	266	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	0.02	0.04	691	0.068
Depth vibrator	1,307	160	0.59	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
All Terrain Forklift	500	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
				188.96	937.88	4045.12	87.73	159.75	154.96	10.38	22.76	407605	
				3.26	11.67	39.59	1.08	2.23	2.17	0.13	0.28	5013	
				0.85	6.62	19.66	0.52	0.96	0.93	0.06	0.14	2439	
				2.62	14.05	34.99	1.08	2.31	2.24	0.14	0.30	5345	
				18.57	143.57	179.63	4.66	18.99	18.42	0.55	1.21	21683	
				15.18	117.39	146.87	3.81	15.53	15.06	0.45	0.99	17729	
				39.23	184.70	155.27	3.44	27.57	26.74	0.41	0.89	16019	
				104.21	399.70	1179.70	31.33	83.04	80.55	3.71	8.14	145749	
				27.84	215.23	269.27	6.99	28.47	27.62	0.83	1.81	32505	
			Subtotal (lbs):	**401**	**2031**	**6070**	**141**	**339**	**329**	**17**	**37**	**654,088**	

Table 5. Paving

Pavement - Surface Area 15,225 SF 188 CY

Paving - HMA 5,075 CF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Grader	47	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	0.01	0.03	536	0.052
Roller	70	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	0.01	0.03	536	0.052
Paving Machine	93	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	0.01	0.03	536	0.052
Asphalt Curbing Machine	9	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	38	230	10	0.002	0.008	0.038	0.000	0.002	0.002	0.00001	1.124E-05	3.439
Water Truck	1	230	10	0.002	0.008	0.038	0.000	0.002	0.002	0.00001	1.124E-05	3.439

Hot Mix Asphalt (HMA)	Volume of HMA (ft^3)	Weight of HMA (tons)	VOC[3] lb/ton of asphalt	CO lb/ton of asphalt	Nox lb/ton of asphalt	SO_2 lb/ton of asphalt	PM10 lb/ton of asphalt	PM2.5 lb/ton of asphalt
	5,075	368	0.04	-	-	-	-	-

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
3.34	12.52	36.89	1.02	2.62	2.54	0.12	0.27	4,751
12.46	89.92	202.09	4.21	12.37	12.00	0.50	1.09	19,570
7.54	28.62	84.36	2.29	5.95	5.77	0.27	0.59	10,634
0.60	2.39	6.95	0.18	0.49	0.47	0.02	0.05	816

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
0.60	3.16	14.38	0.01	0.61	0.59	0.00	0.00	1,307
0.02	0.08	0.38	0.00	0.02	0.02	0.00	0.00	34

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
14.72	-	-	-	-	-	-	-	-
39	**137**	**345**	**8**	**22**	**21**	**1**	**2**	**37,112**

Subtotal (lbs):

Table 6. Fugitive Dust

PM_{10} tons/acre/mo	acres	days	PM_{10} Tons	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ Tons
0.42	20.8	125	54.7	0.1	5.5

Table 7. Construction Summary

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 300	0.45	1.95	6.11	0.14	55.05	5.81	641

TAB D. CONSTRUCTION EMISSIONS - AREA 400

Basic Conversions

453.59 grams per pound
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4
0.26 g/gal N2O

LAND-BASED ACTIVITIES

Table 1. Excavate/Fill - Grading

Site Prep - Excavate/Fill (CY) 370 CY
Grading (SY) 972 SY Assume compact 0.5 feet (0.166 yards) 161 CY compacted

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Backhoe Excavator	2	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	0.01	0.03	536	0.052
Skid Steer Loader	2	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
Dozer	2	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	0.01	0.03	536	0.052
Compactor	1	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052
Grader	1	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (14 CY)	2	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	0.22	0.76	2.55	0.07	0.14	0.14	0.01	0.02	339
	0.06	0.24	0.70	0.02	0.05	0.05	0.00	0.00	87
	0.14	0.53	1.57	0.04	0.11	0.11	0.01	0.01	202
	0.05	0.21	0.60	0.02	0.04	0.04	0.00	0.00	71
	0.13	0.44	1.48	0.04	0.08	0.08	0.00	0.01	195
	VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
	0.03	0.17	0.76	0.00	0.03	0.03	0.00	0.00	69
Subtotal (lbs):	**1**	**2**	**8**	**0**	**0**	**0**	**0**	**0**	**963**

Table 2. Gravel Work 35,144 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	2	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	0.01	0.03	536	0.052
Wheel Loader	2	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Compactor	5	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	0.01	0.03	536	0.052
On-road Equipment	**Hours of Operation**	**Engine HP**	**Speed (mph)**	**VOC^3 lb/mile**	**CO^3 lb/mile**	**NOx^3 lb/mile**	**SO_2^3 lb/mile**	**$PM10^3$ lb/mile**	**$PM2.5^3$ lb/mile**	**N2O lb/mile**	**CH4 lb/mile**	**CO2 lb/mile**	
Dump Truck (onsite)	418	230	7	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439	
Dump truck time based on 10 minutes onsite to arrive, dump, depart.				**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**	
				0.17	0.58	1.96	0.06	0.11	0.11	0.01	0.01	258	
				0.08	0.28	0.96	0.03	0.05	0.05	0.00	0.01	121	
				0.18	0.65	2.17	0.06	0.13	0.12	0.01	0.01	262	
				VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**	
				4.65	24.35	110.84	0.05	4.69	4.55	0.03	0.03	10,070	
			Subtotal (lbs):	**5**	**26**	**116**	**0**	**5**	**5**	**0**	**0**	**10,711**	

Table 3. Foundations and other Concrete Work Total Concrete 227 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Concrete Mixers	16	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	0.01	0.03	588	0.058
Concrete Truck	14	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	0.01	0.03	539	0.053
				VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**	
				0.04	0.16	0.33	0.01	0.03	0.03	0.00	0.00	31	
				1.51	6.95	24.62	0.45	1.07	1.04	0.05	0.12	2,146	
			Subtotal (lbs):	**2**	**7**	**25**	**0**	**1**	**1**	**0**	**0**	**2,177**	

Table 4. Building Construction 5,750 SF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Crane	35	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	0.01	0.03	530	0.052
Concrete truck	35	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	0.01	0.03	536	0.052
Diesel Generator	28	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	0.01	0.03	536	0.052
Telehandler	70	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Scissors Lift	56	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Skid Steer Loader	35	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	0.02	0.04	691	0.068
All Terrain Forklift	4	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
				VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**	
				3.63	18.01	77.68	1.68	3.07	2.98	0.20	0.44	7827	
				1.87	14.48	43.01	1.15	2.09	2.03	0.14	0.30	5335	
				0.28	1.50	3.72	0.11	0.25	0.24	0.01	0.03	569	
				4.59	35.51	44.43	1.15	4.70	4.56	0.14	0.30	5363	
				3.08	23.82	29.80	0.77	3.15	3.06	0.09	0.20	3597	
				5.16	24.30	20.43	0.45	3.63	3.52	0.05	0.12	2108	
				0.22	1.72	2.15	0.06	0.23	0.22	0.01	0.01	260	
			Subtotal (lbs):	**19**	**119**	**221**	**5**	**17**	**17**	**1**	**1**	**25,060**	

Table 5. Paving

Pavement - Surface Area 3,000 SF 37 CY

Paving - HMA 1,000 CF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Grader	9	145	0.59	0.38	1.41	4.16	0.12	0.30	0.29	0.01	0.03	536	0.052
Roller	14	401	0.59	0.34	2.46	5.53	0.12	0.34	0.33	0.01	0.03	536	0.052
Paving Machine	18	164	0.59	0.38	1.44	4.25	0.12	0.30	0.29	0.01	0.03	536	0.052
Asphalt Curbing Machine	2	130	0.59	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	11	230	10	0.002	0.008	0.038	0.000	0.002	0.002	0.00001	1.124E-05	3.439
Water Truck	1	230	10	0.002	0.008	0.038	0.000	0.002	0.002	0.00001	1.124E-05	3.439

Hot Mix Asphalt (HMA)	Volume of HMA (ft^3)	Weight of HMA (tons)	VOC[3] lb/ton of asphalt	CO lb/ton of asphalt	Nox lb/ton of asphalt	SO_2 lb/ton of asphalt	PM10 lb/ton of asphalt	PM2.5 lb/ton of asphalt
	35,206	2,552	0.04	-	-	-	-	-

VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
0.64	2.40	7.06	0.20	0.50	0.49	0.02	0.05	910
2.49	17.98	40.42	0.84	2.47	2.40	0.10	0.22	3,914
1.46	5.54	16.33	0.44	1.15	1.12	0.05	0.11	2,058
0.13	0.53	1.54	0.04	0.11	0.10	0.00	0.01	181
VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
0.17	0.91	4.16	0.00	0.18	0.17	0.00	0.00	378
0.02	0.08	0.38	0.00	0.02	0.02	0.00	0.00	34
VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
102.10	-	-	-	-	-	-	-	-
Subtotal (lbs):	**107**	**27**	**70**	**2**	**4**	**4**	**0**	**0**	**7,476**

Table 6. Fugitive Dust

PM $_{10}$ tons/acre/mo	acres	days	PM $_{10}$ Tons	PM $_{2.5}$/PM $_{10}$ Ratio	PM $_{2.5}$ (tons)
0.42	7.6	1	0.2	0.1	0.0

Table 7. Construction Summary for Land-Based Activity

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 400	0.07	0.09	0.22	0.00	0.17	0.03	21

WATER-BASED ACTIVITIES

Table 8.-10. Berth Area Demolition - Pile and Superstructure Removal

Pile Removal	15.0		155 tons	1050 LF	
Concrete cap removal	100.0 cy		250 tons		
grated walkeay removal	52.0	10' lengths	6.6 tons	520 LF	
concrete deck removed	26.0	20'X12'X2' panels	385 LF	802 CY	
steel truss removal	250 LF		9 trusses total		
Material disposal	15	days for barge & site removal	2,255 tons concrete	2,205 LF concrete piling and steel scrap	

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Excavator	400	232	0.59	0.15	0.32	1.07	0.00	0.22	0.22	0.01	0.03	536	0.052
Loader	153	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
Crane	150	800	0.42	0.28	0.84	4.25	0.00	0.04	0.04	0.01	0.03	530	0.052

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	18	39	129	0	27	26	2	4	64,700
	5	18	54	1	4	4	0	0	6,653
	31	93	472	0	4	4	2	4	58,890
Tons/year:	**0.0**	**0.1**	**0.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**65**

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr
Tug - propulsion	150	500	0.50	0.36	6.62	9.00	1.72	0.40	0.39	0.03	0.12	914
Launch Boat	150	50	0.45	0.36	6.62	9.00	1.72	0.53	0.51	0.03	0.12	914

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	29.55	547.31	744.34	142.30	32.84	31.85	2.19	9.85	75,529
	2.66	49.26	66.99	12.81	3.94	3.82	0.20	0.89	6,798
Tons/year:	**0.02**	**0.30**	**0.41**	**0.08**	**0.02**	**0.02**	**0.00**	**0.01**	**41.16**

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	70	450	10	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.56E-03	1.058E-05	6.722E-05	4.21
Semi-truck	55	380	10	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.56E-03	1.058E-05	6.722E-05	4.21

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	1.11	5.81	26.46	0.01	1.12	1.09	0.01	0.05	2,942
	0.73	3.84	17.48	0.01	0.74	0.72	0.00	0.03	1,943
Tons/year:	**0.00**	**0.00**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.44**

Tables 11 - 13. Berth Reconstruction

Install temporary piles	40	20" piles	steel pipe		
Install new landside piles	10	piles for mooring points and tie back anchors		65	assumed depth
Reinforce existing piles	770	14" piles	140 ft long	1,394	CY concrete total
Install new concrete pile caps	193	caps	356 CY precast concrete		
Install new concrete deck	10,825	SF	802 CY		
Install new steel trusses	3,330	LF piing for all trusses	9 spans total		
Install new grated steel walkways	2,000	SF walkway installed	20 spans total		
Soil stabilization	1,910	total columns	421 Total hours required	35,000	CY aggregate required
Install new equipment	3	weeks			

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Excavator	3,071	232	0.59	0.15	0.32	1.07	0.00	0.22	0.22	0.01	0.03	536	0.052
Loader	251	197	0.23	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
Concrete Truck	244	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	0.01	0.03	536	0.052
Generators	3,920	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	0.01	0.03	536	0.052
Crane	1,819	800	0.42	0.28	0.84	4.25	0.00	0.04	0.04	0.01	0.03	530	0.052
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
				139	297	991	4	206	200	13	28	496,660	
				10	37	109	3	8	7	0	1	13,463	
				13	101	300	8	15	14	1	2	37,187	
				39	209	521	16	34	33	2	4	79,674	
				377	1,132	5,726	5	54	54	19	46	714,044	
			Tons/year:	**0.3**	**0.9**	**3.8**	**0.0**	**0.2**	**0.2**	**0.0**	**0.0**	**671**	

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr
Tug - propulsion	1,819	500	0.50	0.36	6.62	9.00	1.72	0.40	0.39	0.03	0.12	914
Launch Boat	1,819	50	0.45	0.36	6.62	9.00	1.72	0.53	0.51	0.03	0.12	914
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb
				358.35	6,636.13	9,025.13	1,725.39	398.17	386.22	26.54	119.45	915,786
				32.25	597.25	812.26	155.29	47.78	46.35	2.39	10.75	82,421
			Tons/year:	**0.20**	**3.62**	**4.92**	**0.94**	**0.22**	**0.22**	**0.01**	**0.07**	**499**

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	417	450	10	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.56E-03	1.058E-05	6.722E-05	4.21
Dump truck time based on 10 minutes onsite to arrive, dump, depart.				**VOC** lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb
				6.57	34.37	156.45	0.07	6.61	6.43	0.04	0.28	17,395
			Tons/year:	**0.00**	**0.02**	**0.08**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**8.70**

Table 14. Construction Summary for Water-Based Activity

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 400	**0.53**	**4.90**	**9.58**	**1.04**	**0.42**	**0.41**	**1,180**

TAB E. CONSTRUCTION EMISSIONS - AREA 500

Basic Conversions

453.59 grams per pound
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4
0.26 g/gal N2O

Table 1. Clearing 0.1 Acres

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	1	145	0.58	0.38	1.41	4.17	0.12	0.30	0.29	0.01	0.03	536	0.052
Loader	1	87	0.21	1.43	7.35	6.35	0.15	1.06	1.03	0.02	0.04	692	0.068
Small backhoe	1	55	0.21	1.43	7.35	6.35	0.15	1.06	1.03	0.02	0.04	692	0.068

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck	1	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
0.07	0.26	0.77	0.02	0.05	0.05	0.00	0.01	99
0.06	0.30	0.26	0.01	0.04	0.04	0.00	0.00	28
0.04	0.19	0.16	0.00	0.03	0.03	0.00	0.00	18
VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**
0.02	0.08	0.38	0.00	0.02	0.02	0.00	0.00	34
0	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**179**

Subtotal (lbs):

Table 2. Excavate/Fill - Grading

Site Prep - Excavate/Fill (CY) 0 CY
Grading (SY) 12,681 SY Assume compact 0.5 feet (0.166 yards) 2,105 CY compacted

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Compactor	30	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052
Grader	9	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	0.01	0.03	536	0.052

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
1.55	6.18	17.96	0.45	1.26	1.22	0.05	0.12	2,108
1.13	3.96	13.35	0.38	0.74	0.72	0.04	0.10	1,758
3	**10**	**31**	**1**	**2**	**2**	**0**	**0**	**3,866**

Subtotal (lbs):

Table 3. Gravel Work 123 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	1	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	0.01	0.03	536	0.052
Wheel Loader	2	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Compactor	3	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC[3] lb/mile	CO[3] lb/mile	NOx[3] lb/mile	SO_2[3] lb/mile	PM10[3] lb/mile	PM2.5[3] lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (onsite)	1.5	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

Dump truck time based on 10 minutes onsite to arrive, dump, depart.	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	0.08	0.29	0.98	0.03	0.05	0.05	0.00	0.01	129
	0.08	0.28	0.96	0.03	0.05	0.05	0.00	0.01	121
	0.11	0.39	1.30	0.03	0.08	0.07	0.00	0.01	157
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb
	0.02	0.12	0.55	0.00	0.02	0.02	0.00	0.00	50
Subtotal (lbs):	**0**	**1**	**4**	**0**	**0**	**0**	**0**	**0**	**458**

Table 4. Foundations and other Concrete Work Total Concrete 1,310 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Concrete Mixers	69	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	0.01	0.03	588	0.058
Concrete Truck	62	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	0.01	0.03	539	0.053

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	0.16	0.70	1.41	0.03	0.12	0.12	0.00	0.01	135
	6.69	30.78	109.01	2.01	4.74	4.60	0.24	0.53	9,504
Subtotal (lbs):	**7**	**31**	**110**	**2**	**5**	**5**	**0**	**1**	**9,639**

Table 5. Fugitive Dust

PM_{10} tons/acre/mo	acres	days	PM_{10} Tons	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ (tons)
0.42	2.6	16	0.9	0.1	0.1

Table 6. Construction Summary

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 500	0.01	0.02	0.07	0.00	0.88	0.09	6

TAB F. CONSTRUCTION EMISSIONS - AREA 600

Basic Conversions

453.59 grams per pound
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4
0.26 g/gal N2O

Table 1. Excavate/Fill - Grading

Site Prep - Excavate/Fill (CY) 222 CY
Grading (SY) 3,824 SY Assume compact 0.5 feet (0.166 yards) 635 CY compacted

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Backhoe Excavator	1	243	0.59	0.34	1.21	4.03	0.12	0.22	0.22	0.01	0.03	536	0.052
Skid Steer Loader	1	160	0.23	0.38	1.47	4.34	0.12	0.31	0.30	0.01	0.03	536	0.052
Dozer	1	145	0.59	0.38	1.41	4.17	0.12	0.30	0.29	0.01	0.03	536	0.052
Compactor	3	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052
Grader	1	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (14 CY)	1	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
0.11	0.38	1.27	0.04	0.07	0.07	0.00	0.01	169
0.03	0.12	0.35	0.01	0.02	0.02	0.00	0.00	43
0.07	0.27	0.79	0.02	0.06	0.05	0.00	0.01	101
0.16	0.62	1.80	0.05	0.13	0.12	0.01	0.01	212
0.13	0.44	1.48	0.04	0.08	0.08	0.00	0.01	195

VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
0.02	0.08	0.38	0.00	0.02	0.02	0.00	0.00	34
1	**2**	**6**	**0**	**0**	**0**	**0**	**0**	**755**

Subtotal (lbs):

Table 2. Gravel Work 111 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	1	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	0.01	0.03	536	0.052
Wheel Loader	1	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Compactor	3	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	0.01	0.03	536	0.052

On-road Equipment	Hours of Operation	Engine HP	Speed (mph)	VOC[3] lb/mile	CO[3] lb/mile	NOx[3] lb/mile	SO_2[3] lb/mile	PM10[3] lb/mile	PM2.5[3] lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck (onsite)	1.3	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439

Dump truck time based on 10 minutes onsite to arrive, dump, depart.	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	0.08	0.29	0.98	0.03	0.05	0.05	0.00	0.01	129
	0.04	0.14	0.48	0.01	0.03	0.03	0.00	0.00	61
	0.11	0.39	1.30	0.03	0.08	0.07	0.00	0.01	157
	VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb
	0.02	0.11	0.50	0.00	0.02	0.02	0.00	0.00	45
Subtotal (lbs):	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**392**

Table 3. Foundations and other Concrete Work Total Concrete 111 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Concrete Mixers	6	3.5	0.43	0.69	3.04	6.17	0.13	0.54	0.52	0.01	0.03	588	0.058
Concrete Truck	5	300	0.43	0.38	1.75	6.18	0.11	0.27	0.26	0.01	0.03	539	0.053

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	0.01	0.06	0.12	0.00	0.01	0.01	0.00	0.00	12
	0.54	2.48	8.79	0.16	0.38	0.37	0.02	0.04	766
Subtotal (lbs):	**1**	**3**	**9**	**0**	**0**	**0**	**0**	**0**	**778**

Table 4. Building Construction 6,000 SF

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Crane	30	330	0.58	0.25	1.22	5.26	0.11	0.21	0.20	0.01	0.03	530	0.052
Concrete truck	30	300	0.43	0.19	1.45	4.32	0.12	0.21	0.20	0.01	0.03	536	0.052
Diesel Generator	24	40	0.43	0.26	1.41	3.51	0.11	0.23	0.22	0.01	0.03	536	0.052
Telehandler	60	99	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Scissors Lift	48	83	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058
Skid Steer Loader	30	67	0.59	1.69	7.97	6.70	0.15	1.19	1.15	0.02	0.04	691	0.068
All Terrain Forklift	8	84	0.59	0.51	3.94	4.93	0.13	0.52	0.51	0.02	0.03	595	0.058

	VOC lb	CO lb	NOx lb	SO2 lb	PM lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	3.11	15.44	66.58	1.44	2.63	2.55	0.17	0.37	6709
	1.60	12.41	36.86	0.98	1.79	1.74	0.12	0.26	4573
	0.24	1.28	3.19	0.10	0.21	0.20	0.01	0.03	488
	3.94	30.44	38.08	0.99	4.03	3.91	0.12	0.26	4597
	2.64	20.42	25.54	0.66	2.70	2.62	0.08	0.17	3083
	4.42	20.83	17.51	0.39	3.11	3.02	0.05	0.10	1807
	0.45	3.44	4.31	0.11	0.46	0.44	0.01	0.03	520
Subtotal (lbs):	**16**	**104**	**192**	**5**	**15**	**14**	**1**	**1**	**21,777**

Table 5. Fugitive Dust

PM_{10} tons/acre/mo	acres	days	PM_{10} Tons	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ (tons)
0.42	0.8	5	0.1	0.1	0.0

Table 6. Construction Summary

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Area 600	0.01	0.05	0.11	0.00	0.09	0.02	11

TAB G. CONSTRUCTION EMISSIONS - RAIL INFRASTRUCTURE

Basic Conversions

453.59 grams per pound
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4
0.26 g/gal N2O

Table 1. Excavate/Fill - Grading

Site Prep - Excavate/Fill (CY) 0 CY
Grading (SY) 26,378 SY Assume compact 0.5 feet (0.166 yards) 4,379 CY compacted

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Compactor	20	103	0.58	0.40	1.57	4.57	0.12	0.32	0.31	0.01	0.03	536	0.052
Grader	9	285	0.58	0.34	1.21	4.07	0.12	0.23	0.22	0.01	0.03	536	0.052

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
	1.04	4.14	12.03	0.30	0.84	0.82	0.04	0.08	1,412
	1.13	3.96	13.35	0.38	0.74	0.72	0.04	0.10	1,758
Subtotal (lbs):	**2**	**8**	**25**	**1**	**2**	**2**	**0**	**0**	**3,170**

Table 2. Gravel Work 10,726 CY

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/hp-hr	CH4 g/hp-hr	CO2 g/hp-hr	Fuel gal/hp-hr
Dozer	107	185	0.59	0.34	1.21	4.08	0.12	0.23	0.22	0.01	0.03	536	0.052
Wheel Loader	134	87	0.59	0.35	1.25	4.23	0.12	0.24	0.23	0.01	0.03	536	0.052
Compactor	296	103	0.43	0.36	1.34	4.45	0.12	0.26	0.25	0.01	0.03	536	0.052
On-road Equipment	**Hours of Operation**	**Engine HP**	**Speed (mph)**	**VOC[3] lb/mile**	**CO[3] lb/mile**	**NOx[3] lb/mile**	**SO_2[3] lb/mile**	**PM10[3] lb/mile**	**PM2.5[3] lb/mile**	**N2O lb/mile**	**CH4 lb/mile**	**CO2 lb/mile**	
Dump Truck (onsite)	128	230	10	0.00159	0.00831	0.03785	0.00002	0.00160	0.00156	0.00001	1.124E-05	3.439	
Dump truck time based on 10 minutes onsite to arrive, dump, depart.				**VOC lb**	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**	
				8.85	31.09	105.06	2.97	5.82	5.65	0.35	0.77	13,801	
				5.29	18.93	64.19	1.75	3.62	3.51	0.21	0.45	8,128	
				10.39	38.69	128.66	3.33	7.43	7.21	0.39	0.86	15,492	
				VOC lb	**CO lb**	**NOx lb**	**SO2 lb**	**PM10 lb**	**PM2.5 lb**	**N2O lb**	**CH4 lb**	**CO2 lb**	
				2.03	10.62	48.33	0.02	2.04	1.99	0.01	0.01	4,391	
			Subtotal (lbs):	**27**	**99**	**346**	**8**	**19**	**18**	**1**	**2**	**41,811**	

Table 3. Fugitive Dust

PM_{10} tons/acre/mo	acres	days	PM_{10} Tons	$PM_{2.5}/PM_{10}$ Ratio	$PM_{2.5}$ (tons)
0.42	5.5	33	3.8	0.1	0.4

Table 4. Construction Summary

Location	VOC T/yr	CO T/yr	NOx T/yr	SO2 T/yr	PM10 T/yr	PM2.5 T/yr	CO2e MT/yr
Rail Infrastructure	0.01	0.05	0.19	0.00	3.79	0.39	21

TAB H. MATERIALS TRANSPORT FOR CONSTRUCTION

Basic Conversions

453.59 grams per pound
0.26 g/gal N2O
10.21 kg CO2/gal diesel fuel
0.57 g/gal CH4

Kittelson & Associates

Total daily round trips during construction will total 149 round trips for construction workers and 172 round trips for truck deliveries per day. Additionally, removal of demo materials added in.

On-road Equipment	Mileage	Engine HP	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Truck - Clearing Debris/Demo Removal	2,490	450	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
Semi Truck - Demo Removal	93	380	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
Dump Truck - gravel delivery	25,524	230	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
Dump Truck - paving	29,584	230	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
Concrete Truck	6,044	300	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
Delivery Truck	715,520	365	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
Diesel Pickup Truck	6,240	250	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21

	VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	N2O lb	CH4 lb	CO2 lb
Dump Truck - Clearing Debris	3.96	20.70	94.22	0.04	3.98	3.87	0.03	0.03	10,476
Dump Truck - gravel delivery	40.57	212.23	966.03	0.46	40.84	39.70	0.27	0.29	107,411
Dump Truck - paving	47.02	245.99	1,119.69	0.53	47.33	46.01	0.31	0.33	124,497
Concrete Truck	9.61	50.26	228.77	0.11	9.67	9.40	0.06	0.07	25,436
Delivery Truck	1,137.20	5,949.42	27,080.69	12.80	1,144.80	1,112.82	7.57	8.05	3,011,052
Diesel Pickup Truck	9.92	51.88	236.17	0.11	9.98	9.70	0.07	0.07	26,259
Subtotal in lbs	1248	6,530	29,726	14	1257	1222	8	9	3,305,132
Total in Tons	**0.6**	**3.3**	**14.9**	**0.0**	**0.6**	**0.6**	**0.0**	**0.0**	**1,653**
							CO2e in Metric Tons		**1,500**

Table 2. Construction Worker POVs

Vehicles	# trips	Average Roundtrip (mi)	# days	VOC lb/mi	CO lb/mi	NOx lb/mi	SO2 lb/mi	PM10 lb/mi	PM2.5 lb/mi	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
passenger vehicles	149	20	208	0.00119	0.03467	0.00486	0.00001	0.00020	0.00018	3.53E-05	3.53E-05	0.40

			VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	N2O lb	CH4 lb	CO2 lb
			735	21492	3014	8	122	112	22	22	248707
		Total Tons	**0.37**	**10.75**	**1.51**	**0.00**	**0.06**	**0.06**	**0.01**	**0.01**	**124.35**
									CO2e in Metric Tons		**116**

TAB I. CONSTRUCTION SUMMARY BY PROJECT

Basic Conversions

Red text = values from DR1 EN-1.xls

453.59	grams per pound
43,560	Conversion from Acre to SF
0.03704	Cubic feet to Cubic Yards
0.1111	Square Feet to Square Yards
1.4	tons/CY for Gravel
80,000	lbs/Truck Load for Delivery
1.66	CY for each CY of asphalt/concrete demo
0.333333333	asphalt thickness for demolition
0.333333333	asphalt thickness for pavement
2000	pounds per ton
145	lb/ft3 density of Hot Mix Asphalt

Project Name	Clearing (AC)	Grading (SY)	Site Prep - Excavate/Fill (CY)	Building Construction - Total Size (sf)	Building Construction-foundation footprint (sf)	# Stories	Paving - Surface area (SF)	Paving - HMA (CF)	Gravel Work (CY)	Concrete Work - foundation (CY)	Concrete Pilings/Stone columns Required	# Pilings/ Columns	Piling/ column length (FT)	Special Elements/Notes
CONSTRUCTION PROJECTS														
Area 200, Unloading and Office														
General														
Clearing within 7.59-acre facility	0.96	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Buildings/Structures														
Administrative and support buildings	N/A	1133	756	10,200	10,200	1	N/A	N/A	189	567	N/A			
Fire Pump House	N/A	83	56	750	750	1	N/A	N/A	14	42	No			
Rail offloading structure	N/A	18,704	3,039	168,350	N/A	1	48,100	24050	1,998	1,042	Yes			400 LF X 4 Ft wide walkway grating; 5 - 140 LF X 4 Ft wide grated walkways; 90 - 150 LF X 4
Control rooms/ehouses (6)	N/A	550	367	4,950	4,950	1	N/A	N/A	92	275	N/A			
Transformer / compressed air pads	N/A	94	16	N/A	845	N/A	N/A	N/A	16	21	N/A			
Rail Car Spill Tank Area	N/A	N/A	44	N/A	796	N/A	N/A	N/A	15	29	N/A			
Associated construction within Area 200[1]	N/A	N/A	11,385	N/A	N/A	N/A	N/A	N/A	998	1,997	N/A			
Roads/Parking	N/A	N/A												
Parking	N/A	3,722	413	N/A	N/A	N/A	33,500	11,156	413	N/A	N/A			
TOTALS	**1.0**	**24,286**	**16,075**	**184,250**	**17,541**	0	**81,600**	**35,206**	**3,734**	**3,972**	**0**			

Area 300, Storage														
General														
Clearing/Grading within 20.84-acre facility	0	100,866	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Buildings/Structures														
Storage Tank Foundations	N/A	N/A	88,005	N/A	N/A	N/A	N/A	N/A	87,335	670	Yes	5,510	65	5,510 columns from wet vibro for soil stabilization; assume 3 ft diameter. 900,000 sf of geomembrane liner installation.
Storage area berms	N/A	N/A	197,600	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Tank field construction	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			40715 CF of steel used to field construct 6 oil tanks; est 1,070 16ft X 18 ft panels used
Conveyance pump basin	N/A	N/A	171	N/A	N/A	N/A	N/A	N/A	57	114	N/A			
Transformer pads	N/A	N/A	16	N/A	N/A	N/A	N/A	N/A	5	10	N/A			
Fire pump house	N/A	N/A	57	750	930	1	N/A	N/A	16	41	N/A			
Storage building	N/A	N/A	211	2,520	2,520	1	N/A	N/A	47	164	N/A			
Parking - 5 spaces							15225	5,075	141					
Associated construction within Area 300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			680 ' of 24" pipe inside berm for oil to/from tanks
TOTALS	**0**	**100,866**	**286,060**	**3,270**	**3,450**	0	**15,225**	**5,075**	**87,601**	**1,000**	0			
Area 500, Transfer Pipelines														
General														
Clearing /grading within 2.62-acre facility	0.1	12,681	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Concrete Piers for pipelines	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	123	1310	N/A			
Pipelines	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
TOTALS	**0.1**	**12,681**	**0**						**123**	**1,310**				
Area 600, West Boiler														
General														
Clearing /grading within 0.79-acre parcel	N/A	3,824	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Buildings/Structures														
E-house?														
West Boiler Building	N/A	N/A	222	6,000	6,000	4.5	N/A	N/A	111	111	N/A			
TOTALS		**3,824**	**222**	**6,000**	**6,000**	**5**	**0.00**	**0.00**	**111**	**111**	**0**			
Rail Infrastructure														
General														
Clearing/ grading within 5.45-acre footprint	N/A	26,378	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Rail steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			36200 LF of rail steel to be laid and joined together.
Ballast	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10,726	N/A	N/A			
TOTALS	**0.0**	**26,378**	**0**	**0**	**0**	**0**	**0**	**0**	**10,726**	**0**	**0**			

	Clearing (AC)	**Grading (SY)**	**Site Prep - Excavate/Fill (CY)**	**Building Construction - Total Size (sf)**	**Building Construction-foundation footprint (sf)**	**# Stories**	**Paving - Surface area (SF)**	**Paving - HMA (CF)**	**Gravel Work (CY)**	**Concrete Work - foundation (CY)**	**Concrete Pilings/Stone columns Required**	**# Pilings/ Columns**	**Piling/ column length (FT)**	**Special Elements/Notes**
GRAND TOTALS	**1**	**168,034**	**302,357**	**193,520**	**26,991**		**96,825**	**40,281**	**102,295**	**6,392**	**0**			

Notes:
[1] Associated construction for Area 200 includes the 10 pump basins, 2 trenches for crude (1 heated, 1 unheated)

Project Name	Clearing (AC)	Grading (SY)	Site Prep - Excavate/Fill (CY)	Building Construction - Total Size (sf)	Building Construction-foundation footprint (sf)	# Stories	Paving - Surface area (SF)	Paving - HMA (CF)	Gravel Work (CY)	Concrete Work - foundation (CY)	Concrete Pilings/Stone columns Required	# Pilings/ Columns	Piling/ column length (FT)	Special Elements/Notes
Area 400, Marine Terminal														
CONSTRUCTION PROJECTS														
Soil stabilization									35000					
Parking area	N/A	333	37	N/A		N/A	3,000	1,000	37	N/A	N/A	N/A	N/A	estimated at 30' X 100' from Fig 2.2-10 of 7/14 PDEIS
Control Room/E-House	N/A	0	0	0	0	1	N/A	N/A	0	0	N/A	N/A	N/A	assumed to be same size as E-house in Area 300.
MCVU pad	NA	556	278	5000	5000	N/A	N/A	N/A	93	185				
Fire pump and foam building	N/A	83	56	750	750	1	N/A	N/A	14	42	No	N/A	N/A	assumed to be the same size as fire pump house in Area 300.
TOTALS	0	972	370	5,750	5,750		3,000	1,000	35,144	227				
								41,280	**137,438**	**6,619**				

TAB J. CONSTRUCTION ASSUMPTIONS Red text = values from DR1 EN-1.xls

Area 200

Area to be cleared: **0.96 acres**

Fire pump basins =	5 basins measuring 16' wide X 51' long X 15' deep =	2267	CY excavated material
	5 basins measuring 16' wide X 55' long X 15' deep =	2444	CY excavated material
		4711	**CY Total excavated material**
Concrete for basins =	10 sections 16' wide X 51' long X 0.5' thick =	151	CY concrete
	10 sections 15' wide X 51' long X 0.5' thick =	142	CY concrete
	10 sections 16' wide X 55' long X 0.5' thick =	163	CY concrete
	10 sections 15' wide X 55' long X 0.5' thick =	153	CY concrete
		609	**Total CY concrete**
Gravel for basins =	10 sections 16' wide X 51' long X 0.25' thick =	76	CY gravel
	10 sections 15' wide X 51' long X 0.25' thick =	71	CY gravel
	10 sections 16' wide X 55' long X 0.25' thick =	81	CY gravel
	10 sections 15' wide X 55' long X 0.25' thick =	76	CY gravel
		304	**Total CY gravel**
Crude Trenches =	1 trench 9' wide X 5' deep X 1834 ' long =	3,057	CY excavated material
	1 trench 7' wide X 5' deep X 1834' long=	2,377	CY excavated material
		5,434	**CY Total excavated material**
Concrete for trenches =	1 section 9' wide X 1834' long X 0.5' thick =	306	CY concrete
	2 sections 5' wide X 1834' long X 0.5' thick =	340	CY concrete
	1 section 7' wide X 1834' long X 0.5' thick =	238	CY concrete
	2 sections 7' wide X 1834' long X 0.5' thick =	475	CY concrete
		1,359	**Total CY concrete**
Gravel for trenches =	1 section 9' wide X 1834' long X 0.25' thick =	153	CY gravel
	2 sections 5' wide X 1834' long X 0.25' thick =	170	CY gravel
	1 section 7' wide X 1834' long X 0.25' thick =	119	CY gravel
	2 sections 7' wide X 1834' long X 0.25' thick =	238	CY gravel
		679	**Total CY gravel**

piles driven to	75	ft
Assume trench total length	1834	ft
Assume trench total width	18	ft
Assume	**3**	pilings per width
Assume	**5**	ft spans between pilings along length
Total piles	1100	
Productivity	6	piles per day
	183	days

Holding tanks for spill containment

Assume 6 tanks as per DR1 EN-1

Size:	13	ft diameter
	10	ft tall
	133	SF per tank
foundation	5	CY concrete
	29	**Total CY concrete for 6 tanks**
	2	CY gravel
	15	**Total CY gravel for 6 tanks**
	37	**Total CY excavated soil**

Railcar Unloading Facility

Walkways along rail =	4	ft wide X 1850 ft long per DR1 EN-1
	2	walkways total
	14,800	Total SF
	274	**CY Concrete**
	183	**CY gravel**
	457	**Total CY excavated soil**

Foundation for Unloading Facility

Assume use of 7' X 7' spread foundations, spaced 20' apart

94	foundations supports required
4.5	ft foundation depth as per p 4-17 of 7/14 PDEIS
768	**CY Concrete for all foundations**
171	**CY gravel, assuming 1' depth**
746	**Total CY excavated soil**

Ballast for 2 rail lines

1' depth X 12' wide by 1850' long X 2

1,644 CY ballast for both rails (treated as gravel)

Asphalt for rail area

50' wide - 9 ' - 7 ' = 34 feet after removing trench widths

34 ' - 8 ' = 26 feet after removing (2) concrete sidewalk widths

24,050 CF asphalt with a 6" depth

Area 300

Ringwall foundations 4 ' wide X 1 ' thick X 754 ' circumference

=	**670**	**Total CY concrete for all 6 ring wall constructions**
		from DR EN-1.xls
	335	**Total CY gravel for all 6 ring wall constructions**

5,510 stone columns installed in subsurface where tanks will reside
from p. 4-17 July PDEIS

87,000 CY of aggregate to create columns
includes 80,000 CY for under tanks and 7,000 CY for pipeline

Berm Construction

227,000 CY of soil required (from p. 4-117 of July PDEIS)

Field constructed metal tanks

240	ft diameter	754	circumference of tank
48	ft tall		
40,715	**CF steel**	488,580	**sf**
	from DR EN-1.xls		

Assume the tanks are constructed from panels 18' X 16 '

756	Total panels to construct sides
314	Panels for top and bottom
1,070	**Total 18 ' X 16 ' steel panels**

Tank Storage Pump Basin

Basin = 58 ' X 58 ' X 12 ' =	**114**	**CY concrete**
	57	**CY gravel**

Transformer Pads Assume 8" concrete thickness and 4" gravel thickness
420 SF
10 CY Concrete
5 CY gravel

Fire Foam Skid
180 SF
4 CY Concrete
2 CY gravel

Fire Water Pump House 2' footer, 1.5' slab. 0.5' gravel
750 SF
37 CY concrete
14 CY gravel

Storage Bldg 4' footer, 1.5' slab, 0.5' gravel
2,520 SF
164 CY concrete
47 CY gravel

Parking 5 spaces 15,225 SF
5075 CF asphalt
141 CY gravel

Piping inside Berm
680 Ft
24 In dia

Construction time frame estimate from PDEIS 208 days
Assume 50% groundwork time and 50% tank installation
100 days of crane work
Assume 50% daily use 5 hrs per day 500 hrs for tank etc installations

Geomembrane 900,000 SF
assume 43560 SF (1 acre) laid per day
21 days to complete installation

Area 500 **Transfer Pipeline** For estimation purposes, assume all pipelines above grade and use pier count for all concrete/gravel

Aboveground piping:

20 ft - distance between concrete support piers
8 ft spread foundation depth, on average
1 ft - assumed width of foundation above grade
3 ft - assumed width of foundation at depth
16 SF for pier side

Piping:

				Estimated concrete piers	**concrete CY**	**gravel CY**
1,800	ft of 24" dia X 3 to collect at rail unloading stations	6	ft wide minimum	90	320	30
5,500	ft of 24" dia connecting rail unloading to Area 300 storage tanks	2	ft wide minimum	275	326	31
5,300	ft 36" dia to connect storage tanks to vessel loading	4	ft wide minimum	265	628	59
5,300	ft 9" dia to return crude from vessel loading to storage tanks		runs with 36" pipe above			
600	ft 18" dia to carry HC vapor to MVCU	2	ft wide minimum	30	36	3
					1310	**123**

Area 600 **West Boiler Building**

6000 SF 45 ft high
from p. 2-28 of July PDEIS
0.5 ft concrete slab **111 CY concrete**
0.5 ft gravel **111 CY gravel**

E-House?

Rail Infrastructure

2 Tracks constructed 4106 & 4107 4105 4750 CY ballast
7,700 ft long, each
2 Tracks for staging
200 ft, length of 1st staging track
700 ft, length of 2nd staging track

6500 CY ballast 4106 & 4107
from p. 4-117 of July PDEIS
4750 CY ballast 4105
from p. 4-117 of July PDEIS

From DR1 EN-1	Length	Ballast depth (ft)	Track width (ft)	**CY Ballast**
Track 4106 relocation	5,200	1	16	3,081
Track 4107 relocation	5,200	1	16	3,081
Track 4105 construction	7,700	1	16	4,563
				10,726

Area 400

Demo Includes the following elements
Breasting dolphin:
1 breasting dolphin removed. This involves the following components:
15 piles removed using vibratory extraction Assume removal rate of 5 piles per day
11 are 18' and 4 are 12' diameters
Assume pile length of 70 ft
295 lb per ft
155 tons of piling removed

400 SF concrete cap removed 100 CY based on Figure 6 of App A of BE
Assume 2 tons/CY
25 % added weight to cover rebar
250 tons of reinforced concrete removed

1,370 SF grated walkway removed Assume width of 5 ft based on Figure 6 of App A of BE 274 LF
Assume removed in 10 ft lengths 27 lengths
Assume 5 lb/ SF
3.4 tons of steel removed

Berth 13 dock: Dock width = 25'
245 ft approx length of pier
140 ft approx length of dock
385 Total length
10,825 SF concrete deck removed (pre-cast panels) from application 2/14 p. 2-111
- from Figure 5 of App A of BE
2 ft assumed thickness of deck
802 CY concrete (precast) 2 tons/CY
30 ft precast lengths 25 % added weight to cover rebar
12 ft precast widths (2 per run width) 2,005 Tons
26 precast panels

193 concrete pile caps removed
25 ft is assumed length of cap (same as dock width)
2 ft is assumed width of cap (to cover 18" dia piles)
1 ft is assumed thickness
356 CY of concrete removed

250 LF steel trusse removed
9 trusses total

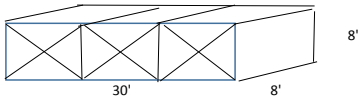
250 LF grated steel walkways between Berth 13 platform and upstream/downstream breasting dolphins removed
Assume 5 ft width
1,250 SF walkway removed
3.1 tons of steel removed

Assume piles are 2' apart (coc)
4 piles across 25' width
770 14" pile installed inside of 18" piles Assume 140 ft depth from DR1 EN-1
estimated from Fig 4 of App A of BE
3 piles per day productivity rate
0.70 SF - Area of the annular ring to be filled with concrete
70 ft presumed length of annular ring
1.8 CY concrete for each pile
1,394 Total CY concrete for all pile annular spaces

193 Install new concrete pile caps
356 CY of concrete installed (precast)

10,825 SF new concrete deck installed
802 CY concrete poured in place

250 LF larger steel trusses installed between Berth 13 platform and upstream/downstream breasting dolphins
8 ft span width
8 ft height
30 ft length
370 LF of piping to construct one span
9 spans total
3,330 Total LF of piping for all trusses



Temporary piles:
40 piles 20 inches 70 ft long estimated
6 piles per day productivity rate
250 LF grated steel walkways between Berth 13 platform and upstream/downstream breasting dolphins installed
Assume 5' width
1,250 SF walkway installed Assume 20 ft lengths 20 spans total
3.1 tons of steel installed
750 SF new grated walkway added between mooring dolphins and shoreline
1.9 tons of steel installed

12	8' =	96	ft
4	30' =	120	ft
12	12.8' =	154	ft
		370	ft total

10 new piles for mooring points and tie back anchors 65 ft assumed depth
6 piles per day productivity rate

Vibratory replacement for soil stabilization
Assume 120 HP vibrator
production rate 300 m/10 hr shift
30 m/hour
295 ft/hr
5510 total columns required for Area 300
70 ft assumed depth
385,700 total depth required
1,307 Total hours required
1,910 total columns required for Area 400
65 ft assumed depth
124,150 LF total depth required
421 Total hours required
35000 CY aggregate required

Fugitive Dust
Based on 208 days of construction from PDEIS
Used grading as parameter available for all areas and divided
construction days based on percent of grading each area represents

Area 200	14%	29
Area 300	60%	125
Area 400	1%	1
Area 500	8%	16
Area 600	2%	5
Rail Infrast.	16%	33

Materials:

Concrete	from CalPortland - Vancouver RM Plant West
	2327 West Mill Plain Blvd
Aggregate	from CalPortland
	3101 NW Gateway
Asphalt	from Albina Asphalt
	1112 West 7th Street
Green waste	within 8 mile radius
C&D	City Bark
	2419 N Andresen Rd
Scrap Steel	Metro Metals Northwest
	900 Port Way

TAB K. MOBILE SOURCE OPERATIONAL EMISSIONS

Table 1. Line Haul Locomotive Emissions - In Terminal

Line Haul engines:

per engine fuel consumption: 3.3 gal/hr at idle
47 gal/hr at Notch 3
Hydrocarbon (HC) emission factor: 5.1 g/gal
VOC conversion factor: 1.053
CO emission factor: 38.064 g/gal

NOx emission factor: 114 g/gal
SO2 emission factor: 0.09 g/gal
PM10 emission factor: 2.9 g/gal
PM2.5 emission factor: 2.81 g/gal
CO2 emission factor 10,218 g/gal

diesel density 3,218 g/gal
CH4 emission factor: 0.80 g/gal
N2O emission factor: 0.26 g/gal

Activity: 3 engines/train 4 trains/day 365 days per year

Rail Activity	Notch	Time (min)	Distance (ft)	Speed (mph)	Distances (mi)	Gallons diesel consumed	HC Tons/Yr	VOC Tons/Yr	CO Tons/Yr	NOx Tons/Yr	SO2 Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	N2O Tons/Yr	CH4 Tons/Yr	CO2 Tons/Yr	CO2e Ton/Yr	Formaldehyde (Ton/yr)
Spur to facility	3	15	10,686	8.1	2.02	11.75	0.29	0.30	2.16	6.47	0.01	0.16	0.16	0.01	0.05	580	585	0.00
Wait for switch at facility yard	Idle	10	0	0.0	0.0	0.55	0.01	0.01	0.10	0.30	0.00	0.01	0.01	0.00	0.00	27	27	0.00
Proceed forward to personnel switch	3	10	6,585	7.5	1.25	7.83	0.19	0.20	1.44	4.31	0.00	0.11	0.11	0.01	0.03	386	390	0.00
Switch personnel, BNSF> Savage	Idle	10	0	0.0	0.0	0.55	0.01	0.01	0.10	0.30	0.00	0.01	0.01	0.00	0.00	27	27	0.00
Proceed forward to unloading	3	5	2,956	6.7	0.56	3.92	0.10	0.10	0.72	2.16	0.00	0.05	0.05	0.00	0.02	193	195	0.00
Unload	Idle	120	0	0.0	0.0	6.6	0.16	0.17	1.21	3.63	0.00	0.09	0.09	0.01	0.03	326	329	0.00
Proceed forward 1800 ft	3	3	1,800	6.8	0.34	2.35	0.06	0.06	0.43	1.29	0.00	0.03	0.03	0.00	0.01	116	117	0.00
Unload	Idle	120	0	0.0	0.0	6.6	0.16	0.17	1.21	3.63	0.00	0.09	0.09	0.01	0.03	326	329	0.00
Proceed forward 1800 ft	3	3	1,800	6.8	0.34	2.35	0.06	0.06	0.43	1.29	0.00	0.03	0.03	0.00	0.01	116	117	0.00
Unload	Idle	120	0	0.0	0.0	6.6	0.16	0.17	1.21	3.63	0.00	0.09	0.09	0.01	0.03	326	329	0.00
Proceed forward 1800 ft	3	3	1,800	6.8	0.34	2.35	0.06	0.06	0.43	1.29	0.00	0.03	0.03	0.00	0.01	116	117	0.00
Unload	Idle	120	0	0.0	0.0	6.6	0.16	0.17	1.21	3.63	0.00	0.09	0.09	0.01	0.03	326	329	0.00
Exit unloading area	3	3	1,800	6.8	0.34	2.35	0.06	0.06	0.43	1.29	0.00	0.03	0.03	0.00	0.01	116	117	0.00
Switch personnel, Savage> BNSF, Inspection	Idle	60	0	0.0	0.0	3.3	0.08	0.09	0.61	1.82	0.00	0.05	0.04	0.00	0.01	163	164	0.00
Proceed to spur	3	10	5,376	6.1	1.02	7.83	0.19	0.20	1.44	4.31	0.00	0.11	0.11	0.01	0.03	386	390	0.00
Wait for track alignment	Idle	10	0	0.0	0.0	0.55	0.01	0.01	0.10	0.30	0.00	0.01	0.01	0.00	0.00	27	27	0.00
						Total	**1.8**	**1.9**	**13.2**	**39.7**	**0.0**	**1.0**	**1.0**	**0.1**	**0.3**	**3,556**	**3,590**	**0.01**

Table 2. Switching Locomotive Emissions - In Terminal

Switching engine activity:
2 cars removed/train
20 minutes to remove/car
40 minutes to remove/train
4 trains/day
160 minutes total switching/day

Hydrocarbon (HC) emission factor: 0.78 g/bhp-hr
VOC conversion factor: 1.053
CO emission factor: 1.83 g/bhp-hr
In-use HP 213.45

NOx emission factor: 13.55 g/bhp-hr
SO2 emission factor: 0.01 g/bhp-hr
PM10 emission factor: 0.30 g/bhp-hr
PM2.5 emission factor: 0.29 g/bhp-hr
CO2 emission factor 672 g/bhp-hr

CH4 emission factor: 0.05 g/bhp-hr
N2O emission factor: 0.02 g/bhp-hr

Rail Activity	Notch	Time (hr/yr)	HC Tons/Yr	VOC Tons/Yr	CO Tons/Yr	NOx Tons/Yr	SO2 Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	N2O Tons/Yr	CH4 Tons/Yr	CO2 Tons/Yr	CO2e Ton/Yr	Formaldehyde (Ton/yr)
Switching cars	2	973.3	0.2	**0.2**	**0.4**	**3.1**	**0.00**	**0.07**	**0.07**	**0.004**	**0.01**	**154.0**	**155.4**	**0.0069**

Table 3. Total Onsite Rail Emissions

VOCs (Ton/yr)	CO (Ton/yr)	NOx (Ton/yr)	SO2 (Ton/yr)	PM10 (Ton/yr)	PM2.5 (Ton/yr)	N2O (Ton/yr)	CH4 (Tons/yr)	CO2 (Ton/yr)	CO2e (MTon/yr)	Formaldehyde (Ton/yr)
2.06	**13.67**	**42.78**	**0.03**	**1.08**	**1.04**	**0.09**	**0.29**	**3710.20**	**3745.60**	**0.02**

Tables 4 and 5. Vessel Data

Vessel Type	Engine Type	Power (kW)
Tanker	Main	8,680
	Auxiliary	2,400
	Boiler	371
Tugs	Main	1,420
	Auxiliary	110

Vessel	Engine	Mode	Load %
Tanker	Main	Cruise Outer	83%
		Cruise Inner	36%
		Maneuver	4.6%
	Auxiliary	Cruise	24%
		Reduced Speed Zone	28%
		Maneuver	33%
		Hotelling	26%
Tug	Main	All	85%
	Auxiliary	All	56%

Table 6. Emission Factors

Emission Factors (g/kWh)					
	Tanker - Main	Tanker - Aux	Tanker - Boiler	Tugs - Main	Tugs - Aux
HC	0.6	0.4	0.1	0.27	0.27
CO	1.4	1.1	0.2	5	5
NOx	17	13.9	2	6.8	6.8
SO2	3.62	4.24	5.67	1.3	0.16
PM10	0.45	0.49	0.58	0.3	0.3
PM2.5	0.42	0.45	0.53	0.291	0.291
N2O	0.031	0.031	0.031	0.09	0.09
CH4	0.006	0.008	0.008	0.02	0.02
CO2	589	691	691	690	690

Assume Slow Steam Diesel (SSD); Marine Diesel Oil; 1.00% Sulfur
BSFCmain = 185; BSFCaux= 217; BSFCboiler= 290
Boiler emissions (g/mode) = Boiler Energy (kW) x ST EFs (g/kWh) x time in mode (hrs)
Current Methodologies in Preparing Mobile Source Port-Related Emission Ivnventories - Final report April 2009 3.206 g CO2/g MDO
SO2 EF for tug auxilliary engine assumed to be the same as for same sized nonroad equipment.

Table 7. On-Site Emissions

Mode	Engine	Time in Mode (Hr)	Time per Year (Hr)	VOCs (Ton/yr)	CO (Ton/yr)	NOx (Ton/yr)	SO2 (Ton/yr)	PM10 (Ton/yr)	PM2.5 (Ton/yr)	N2O (Ton/yr)	CH4 (Tons/yr)	CO2 (Ton/yr)	CO2e (Ton/yr)	Formaldehyde (Ton/yr)
Transit	Main	0.2	73	0.15	0.36	4.32	0.92	0.11	0.11	0.01	0.00	150	152	0.02
	Auxiliary	0.2	73	0.02	0.06	0.75	0.23	0.03	0.02	0.00	0.00	37	38	0.00
	Boiler	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tugs - Main	0.2	73	0.03	0.49	0.66	0.13	0.03	0.03	0.01	0.00	67	70	0.00
	Tugs - Auxiliary	0.2	73	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	3	4	0.00
Maneuvering	Main	2	730	1.08	1.75	10.00	2.08	0.35	0.33	0.01	0.00	333	336	0.16
	Auxiliary	2	730	0.25	0.70	8.86	2.70	0.31	0.29	0.02	0.01	440	446	0.04
	Boiler	2	730	0.03	0.06	0.60	1.69	0.17	0.16	0.01	0.00	206	209	0.00
	Tugs - Main[2]	4	1460	0.52	9.71	13.21	2.53	0.58	0.57	0.17	0.04	1,341	1,394	0.08
	Tugs- Auxiliary[2]	4	1460	0.03	0.50	0.67	0.02	0.03	0.03	0.01	0.00	68	71	0.00
Hotelling	Auxiliary	17	6205	1.71	4.70	59.34	18.10	2.09	1.92	0.13	0.03	2,949	2,989	0.26
	Boiler	17	6205	0.25	0.51	5.08	14.39	1.47	1.35	0.08	0.02	1,753	1,777	0.04
			Totals:	**4.08**	**18.85**	**103.52**	**42.79**	**5.19**	**4.80**	**0.45**	**0.11**	**7,348**		0.61
											CO2e in Metric Tons		**6,791**	

[1]Main engines under maneuvering EFs have load load multiplicative adjustment factors applied from Table 2-15 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, USEPA, April 2009.
[2]Hours are increased to account for two tugs per vessel

Table 8. Employee POV Commuter Emissions

Vehicles	# trips	Average trip (mi)	# days	VOC lb/mi	CO lb/mi	NOx lb/mi	SO2 lb/mi	PM10 lb/mi	PM2.5 lb/mi	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
passenger vehicles	532	8	365	0.00119	0.03467	0.00486	0.00001	0.00020	0.00018	3.53E-05	3.53E-05	0.40
				VOCs lb	CO lb	NOx lb	SO_2 lb	PM_{10} lb	$PM_{2.5}$ lb	N2O lb	CH4 lb	CO2 lb
			Passenger vehicles	1841	53864	7555	20	306	282	55	55	623,308
			Total Tons	**0.92**	**26.93**	**3.78**	**0.01**	**0.15**	**0.14**	**0.03**	**0.03**	**312**
											CO2e in Metric Tons	**291**

Table 9. Total Emissions from Operational Mobile Sources

VOCs (Ton/yr)	CO (Ton/yr)	NOx (Ton/yr)	SO2 (Ton/yr)	PM10 (Ton/yr)	PM2.5 (Ton/yr)	N2O (Ton/yr)	CH4 (Tons/yr)	CO2 (Ton/yr)	CO2e (MTon/yr)	Formaldehyde (Ton/yr)
7.06	**59.45**	**150.08**	**42.83**	**6.42**	**5.98**	**0.57**	**0.43**	**11,370**	**10,827**	**0.63**

Table 10. In Transit Vessel Emissions

Vessel	Engine	Mode	Load %	Distance (mi)	Speed (mph)	Time (hrs)	Trips/year	VOCs (Ton/yr)	CO (Ton/yr)	NOx (Ton/yr)	SO2 (Ton/yr)	PM10 (Ton/yr)	PM2.5 (Ton/yr)	N2O (Ton/yr)	CH4 (Tons/yr)	CO2 (Ton/yr)	CO2e (Ton/yr)	Formaldehyde (Ton/yr)
	Main	Cruise Outer	83%	3.453	11.5	0.3	730	1.04	2.44	29.57	6.30	0.78	0.73	0.05	0.01	1,024	1,041	0.16
Tanker	Main	Cruise Inner	36%	115	11.5	9.989		15.24	35.56	431.82	91.95	11.43	10.67	0.79	0.15	14,956	15,195	2.28
	Auxiliary	Cruise Outer	24%	3.453	11.5	0.3	730	0.06	0.15	1.93	0.59	0.07	0.06	0.00	0.00	96	97	0.01
	Auxiliary	Cruise Inner	28%	115	11.5	9.989		2.16	5.94	75.10	22.91	2.65	2.43	0.17	0.04	3,732	3,783	0.32
							Totals	**18.50**	**44.09**	**538.43**	**121.75**	**14.93**	**13.89**	**1.01**	**0.21**	**19,808**		2.77
																CO2e in Metric Tons	**18,248**	

In transit emissions include travel from near the oil terminal to the 3 mile nautical boundary that lies off the coast of Washington/Oregon. Most of the distance (~115 miles) is traversing the Columbia River.

Table 11. In Transit Train Emissions

Rail Alignment	Distances (mi)	Max Crude Volume Transported/day/train (bbl)	Crude Mass Transported/day/train (tons)	Fuel consumption rate (gal/GTM)	Daily fuel use (gal)	Annual Fuel use (gal)	# Trips/day	HC Tons/Yr	VOC Tons/Yr	CO Tons/Yr	NOx Tons/Yr	SO2 Tons/Yr	PM10 Tons/Yr	PM2.5 Tons/Yr	N2O Tons/Yr	CH4 Tons/Yr	CO2 Tons/Yr	CO2e Ton/Yr	Formaldehyde (Ton/yr)
Columbia River	433	90,000	17,324	0.0010	7,866	2,871,152	4	67.23	70.80	501.79	1,502.84	1.25	38.23	37.08	3.43	10.55	134,705	135,990	0.12
Central WA (via Stampede Pass)	648	0	4,491	0.0010	3,052	1,113,873	4	26.08	27.47	194.67	583.03	0.48	14.83	14.39	1.33	4.09	52,259	52,758	0.05
							Totals		98.26	696.46	2,085.87	1.73	53.06	51.47	4.76	14.64	186,964	188,748	0.17
																CO2e in Metric Tons		**171,229**	

BNSF total diesel consumption 1,390,594,369 gallons for freight in 2014
Gross ton-miles 1,326,098,381,000
BNSF data from 2014 R-1 Annual Report

tank car empty weight	65,000	pounds	32.5	tons	3,900 tonnage of 118 tanker cars and 2 buffer cars
locomotive weight	394,000	pounds	197	tons	591 tonnage of 3 locomotives
					4,491 total tonnage of rail equipment

Table 12. Comparison of Estimated Maximum Vessel Emissions to the 2011 Washington State Emission Inventory for Commercial Vessels and the 2009-2010 Washington State Greenhouse Gas Emission Inventory for Marine Vessels

	Tons per Year						
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2*e*
2011 WA EI Marine	782	2,521	20,486	11,529	1,213	1,021	3,000,000
% of EI that project emissions represent	2%	2%	3%	1%	1%	1%	1%

Table 13. Comparison of Estimated Maximum Rail Emissions to the 2011 Washington State Emission Inventory for Rail and the 2009-2010 Washington State Greenhouse Gas Emission Inventory for Rail

	Tons per Year						
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2*e*
2011 WA EI RR	810	2,536	15,026	95	430	428	500,000
% of EI that project emissions represent	12%	27%	14%	2%	12%	12%	34%

TAB L. OPERATIONAL GHG EMISSIONS

Conversions:			MT = Metric Tons
1 lb =	0.4536	kg	
1 metric ton =	1,000	kg	
1 kW-hr =	3,412	Btu	
1 MW =	1,000	kW	
year =	365	days	
MMBtu =	1,000,000	Btu	

Table 1. GHG Emissions from Electricity Consumption By Terminal Operations (Scope 2)
Electricity grid for the region is provided by the Western Interconnection,
which is supported by the Western Electricity Coordinating Council (WECC)
Washington State falls into the subregion WECC Northwest (NWPP)

GHG Emission Factors for NWPP (from EPA's e-Grid):

CO2 =	842.58	lb/Mwh
CH4 =	16.05	lb/Mwh
N2O =	13.07	lb/Mwh
CO2e =	5,138.69	lb/Mwh

Operational consumption estimate:	
231,100	kW-hr per day
365	day/yr
84,352	MW-hr/yr
196,616	**Metric Tons CO2e/year**

Table 2.GHG Emissions from Natural Gas Consumption By Terminal Operations (Scope 1)

GHG Emission Factors for Natural Gas:

CO2 =	53.06	Kg/MMBtu
CH4 =	0.001	Kg/MMBtu
N2O =	0.0001	Kg/MMBtu
CO2e =	53.1148	Kg/MMBtu

Operational consumption estimate:		
1,188,576	MMBTU/year	This estimate was provided by applicant
63,131	**Metric Tons CO2e/year**	

Table 3. GHG Emissions from Onsite Stationary Sources Not Using Natural Gas (Scope 1)
(from Air Permit Application Revisions Docket No. EF 131590, Vancouver Energy 2014)

Stationary Source	**CO2e (MT/yr)**
Vapor Combusion Units	51,913
Emergency Fire Pumps	12
Tank Emissions	236
Equipment Leaks (Fugitive)	138
Total	**52,299**

Table 4. Twenty Year Lifecycle GHG Emissions for Terminal Operations in Metric Tons (All GHG Emissions)

Operational Activity	**CO_2e**
Scope 1 Emissions:	
Stationary Source Operations Consuming Natural Gas	1,262,620
Stationary Source Operations Not Consuming Natural Gas	1,045,980
Total Scope 1 Emissions	**2,308,600**
Scope 2 Emissions:	
Estimated Electricity Purchase/Consumption	3,932,315
Scope 3 Emissions (see Tab K):	
Rail Crude Delivery (transiting within Washington)	3,424,583
Vessel Transport (transiting from Terminal to Washington 3-mile Nautical Boundary)	364,964
Onsite Mobile Source Operation (rail, vessel, commuting staff)	216,539
Total Scope 3 Emissions	**4,006,086**
Total Lifecycle CO2e Emissions in Metric Tons	**10,247,000**

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