Appendix B2, **Climate Change / Greehouse Gas Data**

Phase 1 Construction Emissions

Year 2012

Grading

Duration (days): 264

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Graders	132.7	0.0155	0.0035	8	6	796.2	0.0930	0.0210	0.0982	0.0222
Scrapers	262.5	0.0289	0.0068	8	15	3937.5	0.4335	0.1020	0.4578	0.1077
Rubber Tired Dozers	239.1	0.0305	0.0062	8	6	1434.6	0.1830	0.0372	0.1932	0.0393
Plate Compactors	4.3	0.0005	0.0001	8	3	12.9	0.0015	0.0003	0.0016	0.0003
Off-Highway Trucks	260.1	0.0224	0.0067	8	6	1560.6	0.1344	0.0402	0.1419	0.0425
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0255	0.0047
								Total Emissions	0.9182	0.2167

Total Construction Emissions - Year 2012

tons/year	0.92	0.22
metric tons/year	0.83	0.20
metric tons CO_2 eq/year	258.24	4.13

Year 2013

Grading

Duration (days): 132

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Graders	132.7	0.0155	0.0035	8	6	796.2	0.0930	0.0210	0.0982	0.0222
Scrapers	262.5	0.0289	0.0068	8	15	3937.5	0.4335	0.1020	0.4578	0.1077
Rubber Tired Dozers	239.1	0.0305	0.0062	8	6	1434.6	0.1830	0.0372	0.1932	0.0393
Plate Compactors	4.3	0.0005	0.0001	8	3	12.9	0.0015	0.0003	0.0016	0.0003
Off-Highway Trucks	260.1	0.0224	0.0067	8	6	1560.6	0.1344	0.0402	0.1419	0.0425
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0255	0.0047
								Total Emissions	0.9182	0.2167

Trenching

Duration (days): 20

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Excavators	119.6	0.0134	0.0031	8	12	1435.2	0.1608	0.0372	0.0129	0.0030
Other General Industrial Equipment	152.2	0.0166	0.004	8	6	913.2	0.0996	0.0240	0.0080	0.0019
								Total Emissions	0.0208	0.0049

Paving

Duration (days): 66

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Paving Equipment	68.9	0.012	0.0018	8	6	413.4	0.0720	0.0108	0.0190	0.0029
Pavers	77.9	0.016	0.002	8	3	233.7	0.0480	0.0060	0.0127	0.0016
Rollers	67.1	0.0106	0.0018	6	6	402.6	0.0636	0.0108	0.0126	0.0021
								Total Emissions	0.0443	0.0066

Total Construction Emissions - Year 2013

tons/year	0.96	0.22
metric tons/year	0.87	0.20
metric tons CO_2 eq/year	269.44	4.27

Year 2014

Building

Duration (days): 198

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	6	6	326.4	0.0372	0.0084	0.0221	0.0050
Welders	25.6	0.0073	0.0007	8	9	230.4	0.0657	0.0063	0.0520	0.0050
Generator Sets	61	0.0087	0.0016	8	3	183.0	0.0261	0.0048	0.0207	0.0038
Cranes	128.7	0.0144	0.0033	6	3	386.1	0.0432	0.0099	0.0257	0.0059
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	8	3	200.4	0.0276	0.0051	0.0219	0.0040
								Total Emissions	0.1423	0.0237

Total Construction Emissions - Year 2014

tons/year	0.14	0.02
metric tons/year	0.13	0.02
metric tons CO_2 eq/year	40.02	0.45

Year 2015

Building

Duration (days): 198

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	6	6	326.4	0.0372	0.0084	0.0221	0.0050
Welders	25.6	0.0073	0.0007	8	9	230.4	0.0657	0.0063	0.0520	0.0050
Generator Sets	61	0.0087	0.0016	8	3	183.0	0.0261	0.0048	0.0207	0.0038
Cranes	128.7	0.0144	0.0033	6	3	386.1	0.0432	0.0099	0.0257	0.0059
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	8	3	200.4	0.0276	0.0051	0.0219	0.0040
								Total Emissions	0.1423	0.0237

Total Construction Emissions - Year 2015

tons/year	0.14	0.02
metric tons/year	0.13	0.02
metric tons CO_2 eq/year	40.02	0.45

Notes:

Construction Equipment Emission Factor Source: SCAQMD, Air Quality Analysis Handbook, Off-Road Mobile Source Emissions Factors, October 2008. (http://www.aqmd.gov/ceqa/handbook/offroad/offroadEF07_25.xls, accessed July 27, 2010).

Refer to the URBEMIS 2007 assumptions and model output for construction equipment assumptions

Phase 2 Construction Emissions

Year 2016

Trenching

Duration (days): 44

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Excavators	119.6	0.0134	0.0031	8	2	239.2	0.0268	0.0062	0.0047	0.0011
Other General Industrial Equipment	152.2	0.0166	0.004	8	1	152.2	0.0166	0.0040	0.0029	0.0007
								Total Emissions	0.0076	0.0018

Building

Duration (days): 220

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	0.0111	0.0025
Forklifts	54.4	0.0062	0.0014	6	3	163.2	0.0186	0.0042	0.0123	0.0028
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0213	0.0039
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	0.0064	0.0006
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0077	0.0014
								Total Emissions	0.0587	0.0113

Total Construction Emissions - Year 2016

tons/year	0.07	0.01
metric tons/year	0.06	0.01
metric tons CO_2 eq/year	18.66	0.25

Year 2017

Building

Duration (days): 264

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	0.0133	0.0030
Forklifts	54.4	0.0062	0.0014	6	3	163.2	0.0186	0.0042	0.0147	0.0033
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0255	0.0047
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	0.0077	0.0007
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0092	0.0017
								Total Emissions	0.0704	0.0135

Total Construction Emissions - Year 2017

tons/year	0.07	0.01
metric tons/year	0.06	0.01
metric tons CO_2 eq/year	19.81	0.26

Year 2018

Building

Duration (days): 66

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	0.0033	0.0008
Forklifts	54.4	0.0062	0.0014	6	3	163.2	0.0186	0.0042	0.0037	0.0008
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0064	0.0012
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	0.0019	0.0002
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0023	0.0004
								Total Emissions	0.0176	0.0034

Total Construction Emissions - Year 2018

tons/year	0.00	0.00
metric tons/year	0.00	0.00
metric tons CO_2 eq/year	0.65	0.01

Notes:

Construction Equipment Emission Factor Source: SCAQMD, Air Quality Analysis Handbook, Off-Road Mobile Source Emissions Factors, October 2008. (http://www.aqmd.gov/ceqa/handbook/offroad/offroadEF07_25.xls, accessed July 27, 2010).

Refer to the URBEMIS 2007 assumptions and model output for construction equipment assumptions

Phase 3 Construction Emissions

Year 2019

Grading

Duration (days): 264

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Graders	132.7	0.0155	0.0035	8	6	796.2	0.0930	0.0210	0.0982	0.0222
Scrapers	262.5	0.0289	0.0068	8	18	4725.0	0.5202	0.1224	0.5493	0.1293
Rubber Tired Dozers	239.1	0.0305	0.0062	8	6	1434.6	0.1830	0.0372	0.1932	0.0393
Plate Compactors	4.3	0.0005	0.0001	8	3	12.9	0.0015	0.0003	0.0016	0.0003
Off-Highway Trucks	260.1	0.0224	0.0067	8	6	1560.6	0.1344	0.0402	0.1419	0.0425
								Total Emissions	0.9843	0.2335

Total Construction Emissions - Year 201

tons/year	0.98	0.23
metric tons/year	0.89	0.21
metric tons CO_2eq/year	276.81	4.45

Year 2020

Trenching

Duration (days): 44

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Excavators	119.6	0.0134	0.0031	8	4	478.4	0.0536	0.0124	0.0094	0.0022
Other General Industrial Equipment	152.2	0.0166	0.004	8	2	304.4	0.0332	0.0080	0.0058	0.0014
								Total Emissions	0.0153	0.0036

Paving

Duration (days): 22

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Paving Equipment	68.9	0.012	0.0018	8	2	137.8	0.0240	0.0036	0.0021	0.0003
Pavers	77.9	0.016	0.002	8	1	77.9	0.0160	0.0020	0.0014	0.0002
Rollers	67.1	0.0106	0.0018	6	2	134.2	0.0212	0.0036	0.0014	0.0002
								Total Emissions	0.0049	0.0007

Building

Duration (days): 198

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	8	3	163.2	0.0186	0.0042	0.0147	0.0033
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	0.0058	0.0006
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0069	0.0013
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	0.0100	0.0023
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0191	0.0035
								Total Emissions	0.0565	0.0110

Total Construction Emissions - Year 202

tons/year	0.08	0.02
metric tons/year	0.07	0.01
metric tons CO_2eq/year	21.57	0.29

Year 2021 - 2031

Building

Duration (days): 2332

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	6	2	108.8	0.0124	0.0028	0.0868	0.0196
Welders	25.6	0.0073	0.0007	8	3	76.8	0.0219	0.0021	0.2043	0.0196
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0812	0.0149
Cranes	128.7	0.0144	0.0033	6	1	128.7	0.0144	0.0033	0.1007	0.0231
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	8	1	66.8	0.0092	0.0017	0.0858	0.0159
								Total Emissions	0.5587	0.0930

Total Construction Emissions - Year 2021 -202

tons/year	0.56	0.09
metric tons/year	0.51	0.08
metric tons CO_2eq/year	157.13	1.77

Notes:

Construction Equipment Emission Factor Source: SCAQMD, Air Quality Analysis Handbook, Off-Road Mobile Source Emissions Factors, October 2008. (http://www.aqmd.gov/ceqa/handbook/offroad/offroadEF07_25.xls, accessed July 27, 2010).

Refer to the URBEMIS 2007 assumptions and model output for construction equipment assumptions

Phase 4 Construction Emissions

Year 2032

Grading

Duration (days): 44

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	8	9	601.2	0.0828	0.0153	0.0146	0.0027
Scrapers	262.5	0.0289	0.0068	8	9	2362.5	0.2601	0.0612	0.0458	0.0108
Rubber Tired Dozers	239.1	0.0305	0.0062	8	3	717.3	0.0915	0.0186	0.0161	0.0033
Excavators	119.6	0.0134	0.0031	8	3	358.8	0.0402	0.0093	0.0071	0.0016
Graders	132.7	0.0155	0.0035	8	3	398.1	0.0465	0.0105	0.0082	0.0018
Off-Highway Trucks	260.1	0.0224	0.0067	8	3	780.3	0.0672	0.0201	0.0118	0.0035
								Total Emissions	0.1035	0.0238

Trenching

Duration (days): 22

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Excavators	119.6	0.0134	0.0031	8	4	478.4	0.0536	0.0124	0.0047	0.0011
Other General Industrial Equipment	152.2	0.0166	0.004	8	2	304.4	0.0332	0.0080	0.0029	0.0007
								Total Emissions	0.0076	0.0018

Paving

Duration (days): 22

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Paving Equipment	68.9	0.012	0.0018	8	2	137.8	0.0240	0.0036	0.0021	0.0003
Pavers	77.9	0.016	0.002	8	1	77.9	0.0160	0.0020	0.0014	0.0002
Rollers	67.1	0.0106	0.0018	6	2	134.2	0.0212	0.0036	0.0014	0.0002
								Total Emissions	0.0049	0.0007

Building

Duration (days): 176

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	8	3	163.2	0.0186	0.0042	0.0131	0.0030
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	0.0051	0.0005
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0061	0.0011
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	0.0089	0.0020
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0170	0.0031
								Total Emissions	0.0502	0.0098

Total Construction Emissions - Year 2032

tons/year	0.17	0.04
metric tons/year	0.15	0.03
metric tons CO_2 eq/year	46.78	0.69

Year 2033

Building

Duration (days): 198

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)	
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	8	3	163.2	0.0186	0.0042	0.0147	0.0033
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	0.0058	0.0006
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	0.0069	0.0013
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	0.0100	0.0023
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	0.0191	0.0035
								Total Emissions	0.0565	0.0110

Total Construction Emissions - Year 2033

tons/year	0.06	0.01
metric tons/year	0.05	0.01
metric tons CO_2 eq/year	15.89	0.21

Notes:

Construction Equipment Emission Factor Source: SCAQMD, Air Quality Analysis Handbook, Off-Road Mobile Source Emissions Factors, October 2008. (http://www.aqmd.gov/ceqa/handbook/offroad/offroadEF07_25.xls, accessed July 27, 2010).

Refer to the URBEMIS 2007 assumptions and model output for construction equipment assumptions

Phase 5 Construction Emissions

Year 2035

Grading

Duration (days): 66

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)		
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	8	9	601.2	0.0828	0.0153	158.7168	0.0219	0.0040
Scrapers	262.5	0.0289	0.0068	8	9	2362.5	0.2601	0.0612	623.7000	0.0687	0.0162
Rubber Tired Dozers	239.1	0.0305	0.0062	8	3	717.3	0.0915	0.0186	189.3672	0.0242	0.0049
Excavators	119.6	0.0134	0.0031	8	3	358.8	0.0402	0.0093	94.7232	0.0106	0.0025
Graders	132.7	0.0155	0.0035	8	3	398.1	0.0465	0.0105	105.0984	0.0123	0.0028
Off-Highway Trucks	260.1	0.0224	0.0067	8	3	780.3	0.0672	0.0201	205.9992	0.0177	0.0053
								Total Emissions	1377.6048	0.1553	0.0356

Trenching

Duration (days): 22

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)		
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Excavators	119.6	0.0134	0.0031	8	4	478.4	0.0536	0.0124	42.0992	0.0047	0.0011
Other General Industrial Equipment	152.2	0.0166	0.004	8	2	304.4	0.0332	0.0080	26.7872	0.0029	0.0007
								Total Emissions	68.8864	0.0076	0.0018

Building

Duration (days): 132

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)		
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	8	3	163.2	0.0186	0.0042	86.1696	0.0098	0.0022
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	13.5168	0.0039	0.0004
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	32.2080	0.0046	0.0008
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	59.4594	0.0067	0.0015
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	92.5848	0.0128	0.0024
								Total Emissions	283.9386	0.0377	0.0073

Total Construction Emissions - Year 2035

tons/year	1730.43	0.20	0.04
metric tons/year	1,569.82	0.18	0.04
metric tons CO_2eq/year	1,569.82	56.42	0.85

Year 2036

Building

Duration (days): 264

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)		
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	8	3	163.2	0.0186	0.0042	172.3392	0.0196	0.0044
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	27.0336	0.0077	0.0007
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	64.4160	0.0092	0.0017
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	118.9188	0.0133	0.0030
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	185.1696	0.0255	0.0047
								Total Emissions	567.8772	0.0753	0.0146

Total Construction Emissions - Year 2036

tons/year	567.88	0.08	0.01
metric tons/year	515.17	0.07	0.01
metric tons CO_2eq/year	515.17	21.19	0.28

Year 2037

Building

Duration (days): 44

Equipment	Emission Factors			Hours/day	Quantity	Emissions (pounds/hour)			Emissions (tons/year)		
	CO_2	CH_4	N_2O			CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Forklifts	54.4	0.0062	0.0014	8	3	163.2	0.0186	0.0042	28.7232	0.0033	0.0007
Welders	25.6	0.0073	0.0007	8	1	25.6	0.0073	0.0007	4.5056	0.0013	0.0001
Generator Sets	61	0.0087	0.0016	8	1	61.0	0.0087	0.0016	10.7360	0.0015	0.0003
Cranes	128.7	0.0144	0.0033	7	1	128.7	0.0144	0.0033	19.8198	0.0022	0.0005
Tractors/Loaders/Backhoes	66.8	0.0092	0.0017	7	3	200.4	0.0276	0.0051	30.8616	0.0043	0.0008
								Total Emissions	94.6462	0.0126	0.0024

Total Construction Emissions - Year 2037

tons/year	94.65	0.01	0.00
metric tons/year	85.86	0.01	0.00
metric tons CO_2eq/year	85.86	3.53	0.05

Notes:

Construction Equipment Emission Factor Source: SCAQMD, Air Quality Analysis Handbook, Off-Road Mobile Source Emissions Factors, October 2008. (http://www.aqmd.gov/ceqa/handbook/offroad/offroadEF07_25.xls, accessed July 27, 2010).

Refer to the URBEMIS 2007 assumptions and model output for construction equipment assumptions

Emissions From Electricity Consumed By Land Uses

Power Utility
City of Banning

Land Use	Amount	kilowatt-hours per year[1]	Emissions Factor (lbs/kWh)		
			CO_2 0.641	N_2O 3.57E-05	CH_4 2.38E-05
Residential (Dwelling Units)	5,387	6460	61,114.56	3.41	2.27
Commercial/Retail (SF)	549,000	27.8	26,802.93	1.49	1.00
Elementary School (SF)	200,000	3.85	1,352.25	0.08	0.05
Wastewater Treatment Plant (MGD)	1.59	1,109,050	3,096.80	0.17	0.12
Golf Course (Acres)	248	2,000	871.06	0.05	0.03
TOTAL - pounds per day	**--**	**--**	**93,237.59**	**5.20**	**3.46**
TOTAL - tons per year	**--**	**--**	**17,015.86**	**0.95**	**0.63**
TOTAL - metric tons per year	**--**	**--**	**15,436.53**	**0.86**	**0.57**

	CO_2	N_2O	CH_4	Total $MTCO_2eq$
metric tons per year	15436.53	0.8604	0.5736	
metric tons CO_2eq per year	**15,436.53**	**266.74**	**12.05**	**15,715.31**

Notes:

1. Usage rate; average for City of Banning. Based on consumption data provided by Fred Mason, Electric Utility Director and Cornelio Datuin, Utility Services Assistant, City of Banning Electric Department on December 15, 2010.

2. Conversion from metric tons per year to metric tons of CO_2eq per year is based upon the EPA Greenhouse Gas Equivalencies Calculator; http://www.epa.gov/cleanenergy/energy-resources/calculator.html (accessed September 21, 2010).

Source for greenhouse gas emissions rates:

California Air Pollution Control Officers Association, *Quantifying Greenhouse Gas Mitigation Measures* , September 2010 and California Climate Action Registry (CCAR) Database, *Power/Utility Protocol* (*PUP) Report* , 2006.

U.S. Energy Information Administration, *Domestic Electricity Emissions Factors 1999-2002* , October 2007. http://www.eia.doe.gov/oiaf/1605/excel/electricity_factors_99-02country.xls (accessed September 21, 2010).

Electricity Reduction Calculations

Measure		Percent Reduction	
2.1.1	15 percent below Title 24	15.0%	(reduction based on implementation of Mitigation Measures GHG-1, which requires energy efficiency measures including the applicant's "Livingsmart" program. GHG-1 requires a 15 percent reduction in energy/natural gas usage beyond the requirements of Title 24 and consistent with Tier 1 of the 2010 California Green Building Standards). Section A4.203 (Performance Approach for Residential Voluntary Tiers) and Section A5.601.2.3 (Non Residential Voluntary Tiers) of the 2010 California Green Building Standards Code, requires Tier 1 voluntary measures to exceed the California Energy Code based on the 2008 energy standards requirement by 15 percent.
	Total	*15.0%*	
		$MTCO_2eq$	
	Total Unmitigated Emissions	15,715.31	
	Mitigated Emissions	13,358.02	

Emissions From Natural Gas Consumed By Land Uses

Land Use	Amount	Cubic feet per unit/square feet/customer per month	Emissions Factor (lbs per million cubic feet)		
			CO_2 1.20E-04	N_2O 2.20E-09	CH_4 2.30E-09
Residential					
Single Family Units	4,182	6665	111.49	0.00	0.00
Multi-Family Units	1,206	4011.5	19.35	0.00	0.00
NonResidential					
Retail/Shopping Center	549000	2.9	6.37	0.00	0.00
School	200,000	35	28.00	0.00	0.00
TOTAL - pounds per day	--	--	**165.21**	**0.00**	**0.00**
TOTAL - tons per year	--	--	**30.1512**	**0.0006**	**0.0006**
TOTAL - metric tons per year	--	--	**2.74E+01**	**5.01E-04**	**5.24E-04**

	CO_2	N_2O	CH_4
metric tons per year	27.35	0.00	0.00
metric tons CO_2eq per year	27.35	0.16	0.01

Notes:

1. Usage rate based on factors from the Energy Information Administration (http://www.eia.doe.gov/emeu/cbecs/cbecsreports.html) accessed September 21, 2010.

2. Conversion from metric tons per year to metric tons of CO_2eq per year is based upon the EPA Greenhouse Gas Equivalencies Calculator; http://www.epa.gov/cleanenergy/energy-resources/calculator.html, accessed September 21, 2010.

Natural Gas Reduction Calculations

Measure		Percent Reduction	
2.1.1	15 percent below Title 24	15.0%	(reduction based on implementation of Mitigation Measures GHG-1, which requires energy efficiency measures including the applicant's "Livingsmart" program. GHG-1 requires a 15 percent reduction in energy/natural gas usage beyond the requirements of Title 24 and consistent with Tier 1 of the 2010 California Green Building Standards). Section A4.203 (Performance Approach for Residential Voluntary Tiers) and Section A5.601.2.3 (Non Residential Voluntary Tiers) of the 2010 California Green Building Standards Code, requires Tier 1 voluntary measures to exceed the California Energy Code based on the 2008 energy standards requirement by 15 percent.
	Total	*15.0%*	

	$MTCO_2eq$
Total Unmitigated Emissions	18,386.51
Mitigated Emissions	15,628.54

Solid Waste - Indirect Emissions

Land Use	Amount	Estimated Solid Waste Generation Rate (tons/sf/yr)	Estimated Solid Waste Generation/ Year (tons)	Emissions Factor (tons CH_4 per tons solid waste)	CH_4 Emissions (tons/year)
Single Family (Dwelling Units)	4,182	2.23	9,326	0.01215	113.31
Multi Family (Dwelling Units)	1,206	1.17	1,411	0.01215	17.14
Commercial/Retail (SF)	549,000	0.0046	2,505	0.01215	30.43
Elementary School (SF)	200,000	0.0013	260	0.01215	3.16
TOTAL - tons per year	**--**	**--**	**--**		**164.05**
TOTAL - metric tons per year	**--**	**--**	**--**		**148.82**

metric tons CO_2eq per year	**3,125.21**

(Methane [CH_4] has a CO_2 equivalency factor of 21)

Source:

Solid waste generation based on rates from CalRecycle data.

http://www.calrecycle.ca.gov/wastechar/WasteGenRates/default.htm (accessed December 15, 2010).

GHG emissions factors are based on CARB, *Local Government Operations Protocol* , May 2010, and IPCC First Order Decay data.

Conversion from metric tons per year to metric tons of CO_2eq per year is based upon the EPA Greenhouse Gas Equivalencies Calculator; http://www.epa.gov/cleanene resources/calculator.html (accessed September 21, 2010).

Reductions from Waste Diversion

City of Banning Diversion Rate = 53%

Emissions from solid waste with recycling = 1,468.85 $MTCO_2eq$

Water Consumption - Indirect Emissions

Water Demand (MG/year):	1,376
Percent Local:	68%
Percent Import:	32%
Percent Indoor/Potable:	68%
Percent Outdoor/Nonpotable:	32%

Notes:

- Proportion of local and import supplies is based on projections in the City of Banning, *2005 Urban Water Management Plan* , December 2005.

- Percent indoor/outdoor is based on project water demand provided in Section 4.14, Water Supply, of the Butterfield Specific Plan EIR.

Energy Intensity of Water Use (kWh): 10,091,100

Local Source:	Chino Basin5 groundwater
Import Source:	SWP to LA Basin surface water

- Energy consumption factors for import and local sources (Beaumont, Banning, Banning Bench, and Cabazon Basins) were not available at the time of this analysis. Therefore, the emissions factors for these sources were used as a proxy.

Water Use Energy Factors (kWh/MG)						
Source	**Supply and Conveyance**	**Treatment**	**Distribution**	**Outdoor Total**	**Wastewater Treatment**	**Indoor Total**
Local	1,982	75	865	2,923	1,299	4,222
Import	2,664	36	407	3,107	612	3,718

Emissions:

	CO_2	N_2O	CH_4	Total $MTCO_2eq$
lbs/year	21,210,684.56	360.55	24.04	
MT/year	9,621.00	0.16	0.01	
$MTCO_2eq$/year	9,621.00	50.70	0.23	**9,671.93**

Abbreviations:

kWh = kilowatt hour

MG = million gallons

SWP = State Water Project

WD = water district

Sources:

California Air Pollution Control Officers Association, *Quantifying Greenhouse Gas Mitigation Measures* , September 2010.

CEC. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF (accessed September 21, 2010).

CEC, 2005. California's Water-Energy Relationship. Final Staff Report. CEC 700-2005-011-SF. Available online at: http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF (accessed September 21, 2010).

NRDC. 2004. Energy Down the Drain: The hidden Costs of California's Water Supply. Prepared by NRDC and the Pacific Institute. Available online at: http://www.nrdc.org/water/conservation/edrain/edrain.pdf (accessed September 21, 2010).

Water Reduction Calculations

Measure		**Percent Reduction**	
4.1.1	Use Reclaimed Water	53.4%	(outdoor only)
4.2.1	Install Low-Flow Water Fixtures	20.0%	(indoor only)
4.2.3	Water Efficient Irrigation	6.1%	(outdoor only)
4.2.4	Water Efficient Landscapes	35.0%	(outdoor only)
	Total Indoor Reduction	*20.0%*	
	Total Outdoor Reduction	*94.5%*	
	Total Water Reduction Overall	*43.7%*	

	$MTCO_2eq$
Total Unmitigated Emissions	9,671.93
Mitigated Emissions	5,445.04

4.1.1 Use Reclaimed Water

The project would use reclaimed/recycled water for nonpotable irrigation (approximately 454 million gallons per year).

GHG emissions reduction = $(Water_{reclaimed}/Water_{nnopotable}) \times ((Electricity_{baseline} - Electricity_{reclaimed})/(Electricity_{baseline}))$

Reclaimed Water (MG):	454
Nonpotable Water (MG):	472
Electricity Baseline (kWh):	4,298
Electricity Reclaimed (kWh):	1,911

= (454/472)/((472x7,592) - (472 x 4,298)/(472x7,592))

= 0.53

4.2.1 Install Low-Flow Water Fixtures

Refer to Mitigation Measure GHG-1(a)(1) and (2).

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Estimated 20% reduction in residential buildings, assuming the Project Applicant commits to installing 100% of fixtures with the lowest flow rates. Estimated 17-31% for residential buildings, assuming the Project Applicant commits to installing 100% of fixtures with the lowest flow rates
Other	Not Quantified

Source: California Air Pollution Control Officers Association, Quantifying Greenhouse Gas Mitigation Measures, September 2010.

4.2.3 Water Efficient Landscapes

Refer to Mitigation Measure GHG-1(a)(4).

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	Assuming an irrigation efficiency of 71% as specified in the Model Water Efficient Landscape Ordinance and no Special Landscape Area - 0% reduction if 100% of vegetation is Moderate PF - 13% reduction if 40% of vegetation is Low PF, 40% is Moderate PF, and 20% is High PF
	- 35% reduction if 50% of vegetation is Low PF and 50% is Moderate PF
	- 70% reduction if 10% of vegetation is Low PF
Other	Not Quantified

PF = Plant Factor (factor of plant water needs)

Source: California Air Pollution Control Officers Association, Quantifying Greenhouse Gas Mitigation Measures, September 2010.

4.2.4 Water Efficient Landscape Irrigation Systems

Refer to Mitigation Measure GHG-1(a)(3).

Emission Reduction Ranges and Variables:

Pollutant	Category Emissions Reductions
CO_2e	6.1% unless project specific data is provided
Other	Not Quantified

The percent reduction in GHG emissions is equivalent to the percent reduction in outdoor water usage. Therefore, if a Project Applicant uses the default percent reduction in water usage associated with installing smart land scape irrigation control systems (6.1%), the resulting reduction in GHG emissions is also 6.1%.

Source: California Air Pollution Control Officers Association, Quantifying Greenhouse Gas Mitigation Measures, September 2010.

Mobile Source Emissions Calculations

Project VMT: 605,635

	Total	Breakdown of		Emission Factor		Emis Passe	al Emis Deliv	Passenger	Delivery	Total Emissions	
	VMT	Passenger	Other	Passenger	Other	pounds/day		tons/year		tons/year	metric tons/year
CO	605,635	362,775	242,860	0.0071	0.0141	2,572.90	3,418.93	469.56	623.95	1,093.51	992.01
NO_X	605,635	362,775	242,860	0.0007	0.0158	258.14	3,830.65	47.11	699.09	746.21	676.95
N_2O[1]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36.36	32.99
ROG	605,635	362,775	242,860	0.0007	0.0021	270.51	501.01	49.37	91.43	140.80	127.73
SO_X	605,635	362,775	242,860	0.0000	0.0000	3.89	6.51	0.71	1.19	1.90	1.72
PM_{10}	605,635	362,775	242,860	0.0001	0.0006	32.89	145.61	6.00	26.57	32.58	29.55
$PM_{2.5}$	605,635	362,775	242,860	0.0001	0.0005	21.16	121.85	3.86	22.24	26.10	23.68
CH_4	605,635	362,775	242,860	0.0001	0.0001	24.33	23.57	4.44	4.30	8.74	7.93
CO_2	605,635	362,775	242,860	1.1009	2.7816	399,370.09	675,546.76	72,885.04	123,287.28	196,172.33	177964.53

	CO_2	N_2O	CH_4	Total $MTCO_2eq$
metric tons per year	177,964.53	32.99	7.93	
metric tons CO_2eq per year	177,964.53	10,226.15	166.53	**188,357.21**

Notes:

1. VMT based upon URBEMIS 2007 model output. URBEMIS2007 uses area-specific EMFAC data and Caltrans trip survey data to calculate project VMT. (California Department of Transportation, *Caltrans Statewide Survey Data* , 1991, and Rimpo and Associates, *URBEMIS2007 for Windows Users' Guide Appendices* , November 2007).

2. Emission Factor based upon EMFAC 2007 (version 2.3), *Highest (Most Conservative) Emission Factors.*

3. Breakdown of Passenger and Other assumes 59.9% auto and 40.1% other based on the fleet mix for the project. The "auto" category consists of light autos (49.0%), and light Trucks <3,750 lbs (10.9%). The "other" category consists of light truck 3,570-5,750 lbs (21.7%), med truck 5,751-8,500 lbs (9.5%), light-heavy truck 8,501-10,000 lbs (1.6%), light-heavy truck 10,000-14,000 lbs (0.6%), med-heavy truck 14,001-33,000 lbs (1.0%), heavy-heavy truck 33,001-60,000 lbs (0.9%), other bus (0.1%), urban bus (0.1%), motorcycle (3.5%), school bus (0.1%), and motor home (1.0%).

4. Emission Factor for N_2O based upon a conversion ratio of 0.04873 from NO_X to N_2O. Based upon California Air Resources Board: *Estimates of Nitrous Oxide Emissions from Motor Vehicles and the Effects of Catalyst Composition and Aging* , 2005.

5. Conversion from metric tons per year to metric tons of CO2eq per year is based upon the EPA Greenhouse Gas Equivalencies Calculator; http://www.epa.gov/cleanenergy/energy-resources/calculator.html

Mobile Source Reduction Calculations

Measure		Percent Reduction
3.1.1	Increase Density	0.2%
3.1.2	Increase Location Efficiency	10.0%
3.1.5	Increase Transit Accessibility	6.4%
3.1.8	Locate Near Bike Path/Lane	0.625%
3.1.9	Improve Design of Development	6.3%
3.2.1	Provide Ped. Network Improvements	0.0%
3.2.2	Provide Traffic Calming Measures	0.0%
3.2.3	Implement a NEV Network	0.0%
	Total	*23.6%*

	$MTCO_2eq$
Total Unmitigated Emissions	188,357.21
Mitigated Emissions	143,973.97

3.1.1 Increase Density

% VMT Reduction = A * B [not to exceed 30%]

A = percentage in jobs per acre = (number of jobs per acre - number of jobs per acre for typical ITE development) / (number of jobs per acre for typical ITE development)

B = Elasticity of VMT with respect to density (0.12)

Project Employment =	1,296	(based on 2.36 employees per 1,000 square feet of commercial/retail uses) Source: The Natelson Company, Inc., *Employment Density Study Summary Report* , Prepared for the Southern California Association of Governments, October 31, 2001.
Project Acreage =	36	
Jobs per Acre =	36.0	
Jobs per Acre for Typical ITE Development =	20	(Source: CAPCOA, *Quantifying Greenhouse Gas Mitigation Measures, Appendix B (Calculation Methods)* , September 2010.

% VMT Reduction = ((43.6 - 20) / (20)) * 0.12 = 0.0960

Scaling Factor for Employment Area: = 0.0024
(employment only makes up 2.5% of the total project area)

Percent VMT Reduction = = 0.24% *If greater than 30%, Set to 30%

3.1.2 Increase Location Efficiency

Suburban Center: 10% (representing VMT reductions for the average suburban center in California versus the statewide average VMT).

CAPCOA defines a suburban center as a development that serves the population of the suburb with office, retail and housing which is denser than the surrounding suburb. The proposed project would provide commercial, retail, and residential uses within close proximitiy. Additionally, the proposed project has increased its density by concentrating the developed areas and expanding the open space areas.

Percent VMT Reduction = 10.00%

3.1.5 Increase Transit Accessibility

The CAPCOA Quantification Report requires a transit station/stop with high-quality, high-frequency bus service located within a 5-10 minute walk or a rail station located within a 20 minute walk. Lower reduction factors are also provided for projects that are 0.5 to 3 miles from a station/stop. The transit service must provide fast, frequent, and reliable service that connects to regional destinations. Additionally, neighborhoods must be designed for walking and cycling.

The project would expand Banning Pass Transit and Riverside County Transit to provide service within the project site, including along Highland Springs Road, Wilson Street, Highland Home Road, and F Street. Although, the exact location of transit stops are not currently known, the addition of just one stop would locate all development within at least 3 miles of a transit stop.

% VMT Reduction = Transit * B [not to exceed 30%]

Transit = Increase in transit mode share = % transit mode share for project - % transit mode share for typical ITE development (1.3%)

Dist. to Transit	Transit mode share calc. equation (where x = dist. of project to transit)
0 - 0.5 miles	-50*x+38
0.5 - 3 miles	-4.4*x+15.2
> 3 miles	no impact

B = adjustments from transit ridership increase to VMT (0.67)

% VMT Reduction = 6.37%

* Assumes distance to transit stations in project is within 3 miles

3.1.8 Locate Project Near Bike Path/Bike Lane

The project must be located within 1/2 mile of an existing Class I or Class II bike lane.

Bicycle lanes would be incorporated into the on-site street design for encouragement of alternative transportation modes. Class II Bicycle Lanes would be included on arterial roads which occur throughout the site and would be within 1/2 mile of any portion of the project. Bicycle racks would be provided at commercial uses and at the multi-family dwelling units. The Project would be located in the vicinity of multiple recreational trails, encouraging walking and bicycling and would .

The circulation plan includes internal loop roads that facilitate transit and connectivity. The Project roadways that are modified collector classification or higher are designed to provide on-street bicycle lanes, minimum 6 feet wide, providing connections to regional and local facilities, and residential areas within the Project. Trails/pathways and sidewalks providing pedestrian safety from vehicles will also be provided along roadways within the Project.

Additionally, proposed Project improvements for Highland Springs Avenue and Highland Home Road would include a bike lane on each side of the right-of-way, as well as other improvements. As a result, the Project would install internal and external class II bike lanes within the Cities of Banning and Beaumont that would take reiders through Beaumont and out to Redlands and other neighboring communities.

% VMT Reduction = 0.625%

3.1.9 Improve Design of Development

% VMT Reduction = Intersections* B

Intersections = percentage increase in intersections versus a typical ITE suburban development

Intersections per square mile =	55	* Refer to attached Land Use Plan Illustrative. The graphic indicates intersections in excess of 55 per square mile. However, the analysis conservatively uses an average of 55 intersections per square mile to represent major connection points. An intersection is defined as a place where two or more roads meet.
Typical ITE suburban development =	36	
B = Elasticity of VMT with respect to percentage of intersections =	0.12	

% VMT Reduction = 6.33%

3.2.1 Provide Pedestrian Network Improvements

Although the proposed project would provide pedestrian network improvements, the extent of these improvements are not yet known. Therefore a reduction is not quantifiable.

3.2.2 Provide Traffic Calming Measures

Although the proposed project would provide traffic calming improvements, the extent of these improvements are not yet known. Therefore a reduction is not quantifiable.

3.2.3 Implement a Neighborhood Electric Vehicle (NEV) Network

The Specific Plan includes a circulation plan to accommodate NEVs or low speed vehicles. However, The project would not provide NEVs to households, nor would it require NEVs per certain number of households. Therefore, a reduction due to NEVs is not quantifiable.

0 500' 1000'
APPROXIMATE

5/31/11 JN 65-100290.019-17532 MAS

BUTTERFIELD SPECIFIC PLAN & EIR

Intersection Map

Figure 1