ENERGY CALCULATIONS

ATTACHMENT C

to the
888 Bransten Road Project Initial Study / Mitigated Negative Declaration

Construction Energy Use

To support the Energy Analysis for the following project: 888 Bransten

Construction Equipment/Vehicles

	# of Vehicles	Hrs per Day	Horse-power	Load Factor	Days in Phase	Fuel Used (gallons)
Demolition						
Rubber Tired Dozers	1	8	247	0.4	20	836
Concrete Saws	1	8	81	0.73	20	556
Tractors/Loaders/Backhoes	3	8	97	0.37	20	1,013
Site Preparation						
Graders	1	8	187	0.41	3	97
Scrapers	1	8	367	0.48	3	224
Tractors/Loaders/Backhoes	1	7	97	0.37	3	44
Grading / Excavation						
Graders	1	8	187	0.41	6	195
Rubber Tired Dozers	1	8	247	0.4	6	251
Tractors/Loaders/Backhoes	2	7	97	0.37	6	177
Trenching / Foundation						
Tractors/Loaders/Backhoes	1	8	97	0.37	6	101
Excavators	1	8	158	0.38	6	152
Building - Exterior						
Cranes	1	8	231	0.29	220	6,237
Forklifts	2	7	89	0.2	220	3,224
Generator Sets	1	8	84	0.74	220	6,433
Tractors/Loaders/Backhoes	1	6	97	0.37	220	2,786
Welders	3	8	46	0.45	220	6,427
Building - Interior / Architectural Coating						
Air Compressors	1	6	78	0.48	10	132
Paving						
Cement and Mortar Mixers	1	8	9	0.56	10	24
Pavers	1	8	130	0.42	10	231
Paving Equipment	1	8	132	0.36	10	201
Rollers	2	8	80	0.38	10	286
Tractors/Loaders/Backhoes	1	8	97	0.37	10	169
Total Fuel Used for Construction Equipment/Vehicles						**29,796** (diesel)

Compression-Ignition Engine Brake-Specific Fuel Consumption (BSFC) Factors [1] used in the above calculations are (in gallons per horsepower-hour/BSFC)

0.0588 <100 horsepower
0.0529 >100 horsepower

Worker Trips

Phase	MPG [2]	Trips	Trip Length (miles)	Total Miles per Day	Days in Phase	Fuel Used (gallons)
Demolition	24	13	10.8	140.4	20	117
Site Prep Phase	24	8	10.8	86.4	3	11
Grading Phase	24	10	10.8	108	30	135
Trenching / Foundation	24	5	10.8	54	6	14
Paving	24	15	10.8	162	10	68
Building Construction	24	49	10.8	529.2	220	4,851
Architectural Coating	24	10	10.8	108	10	45
Total Fuel Used for Construction Worker Trips						**5,240** (gasoline)

Construction Energy Use, Continued

Vendor Trips

Phase	MPG [2]	Trips	Trip Length (miles)	Total Miles per Day	Days in Phase	Fuel Used (gallons)
Demolition	7.4	0	7.3	0	20	0
Site Prep Phase	7.4	0	7.3	0	3	0
Grading Phase	7.4	0	7.3	0	30	0
Trenching / Foundation	7.4	0	7.3	0	6	0
Paving	7.4	0	7.3	0	10	0
Building Construction	7.4	23	7.3	167.9	220	4,992
Architectural Coating	7.4	0	7.3	0	10	0
Total Fuel Used for Vendor Trips						**4,992** (diesel)

Hauling Trips

Phase	MPG [2]	Trips in Phase	Trip Length (miles)	Total Miles in Phase	Fuel Used (gallons)
Demolition	7.4	359	20	7180	970
Site Prep Phase	7.4	0	20	0	0
Grading Phase	7.4	612	20	12240	1,654
Trenching / Foundation	7.4	0	20	0	0
Paving	7.4	78	20	1560	211
Building Construction	7.4	332	20	6640	897
Architectural Coating	7.4	0	20	0	0
Total Fuel Used for Hauling Trips					**3,732** (diesel)

Fuel Use Converted to MMBtu

	Total Construction Fuel Use (gallons)	Conversion Factor Btu/gallon	Source	Fuel Converted to Energy Use
Diesel	**38,520**	137,381	[3]	**5,292** MMBtu
Gasoline	**5,240**	109,786	[4]	**575** MMBtu
Total Energy Use from Construction Fuel				**5,867** MMBtu

Sum of above

Total Construction Energy Use **5,867** **MMBtu**

Operational Energy Use

Operational Vehicular Fuel Use

Gross Annual VMT	1,769,820

Fleet Class	Fleet Mix	VMT per Class	Fuel Ecomony [5]	Fuel Consumption (gallons)		
Light Duty Auto (LDA)	0.443496	784908.09	30.9	25401.56		
Light Duty Truck 1 (LDT1)	0.039351	69644.187	26.63	2615.25		
Light Duty Truck 2 (LDT2)	0.280911	497161.91	24.36	20408.95		
Medium Duty Vehicle (MDV)	0.164293	290769.04	20.2	14394.51		
Motorcycle (MCY)	0.004241	7505.8066	37.06	202.53	Total Gasoline	63,023 gallons
Light Heavy Duty 1 (LHD1)	0.033142	58655.374	18.23	3217.52		
Light Heavy Duty 2 (LHD2)	0.007301	12921.456	16.24	795.66		
Medium Heavy Duty (MHD)	0.012374	21899.753	9.43	2322.35		
Heavy Heavy Duty (HHD)	0.007158	12668.372	6.42	1973.27		
Other Bus (OBUS)	0.004838	8562.3892	8.26	1036.61		
Urban Bus (UBUS)	0.001839	3254.699	5.17	629.54		
School Bus (SBUS)	0.000414	732.70548	7.25	101.06		
Motorhome (MH)	0.000642	1136.2244	9.91	114.65	Total Diesel	10,191 gallons

Note that the above numbers represent gross fuel consumption.

The project is required to implement a TDM program, which would be expected to reduce VMT, resulting in the following gasoline usage:

Anticpated TDM VMT reduction: [6]	20%	
Resultant Total Gasoline Use with TDM Reductions:	50,418	**gallons (gasoline)**

	Total Fuel Use (gallons)	Conversion Factor Btu/gallon	Source	Fuel Converted to Use	Energy
Diesel	10,191	137,381	[3]	1,400	MMBtu
Gasoline	50,418	109,786	[4]	5,535	MMBtu
Total Energy Use from Operational Fuel				**6,935**	MMBtu

Operational Built Environment

Type of Energy	Annual Usage	Units	Converted to MMBtu
Electricity	1.55E+06	kWh	5304
Natural Gas	0	kBtu	0.00

Sum of above

Total Annual Operational Energy Use **12,240** **MMBtu**

Existing and Net Energy Use

Net Operational Vehicular Fuel Energy Use

To determine the net increase in fuel usage, fuel usage of the existing uses at the site can be subtracted from the gross consumption above. The following number also incorproates the TDM reduction identified in the Operational calculations.

Existing Use VMT:	781,260	
Resultant Net Annual Gasoline Use:	28,162	gallons
Resultant Net Annual Diesel Use:	5,692	gallons

	Net Fuel Use (gallons)	Conversion Factor Btu/gallon	Source	Fuel Converted to Use	Energy
Diesel	5,692	137,381	[3]	782	MMBtu
Gasoline	28,162	109,786	[4]	3,092	MMBtu
Total Energy Use from Net Operational Fuel				**3,874**	MMBtu

Existing and Net Operational Built Environment

	Existing			Net
Type of Energy	Annual Usage	Units	Converted to MMBtu	Energy Use in MMBtu
Electricity	4.23E+05	kWh	1443	3862
Natural Gas	1.40E+06	kBtu	1398.04	-1398
Total			2841	**2464**

Sum of above

Total Net Annual Operational Energy Use **6,338** **MMBtu**

Sources

Unless otherwise noted, information in these calculations is from the project-specific Air Quality/Emissions Assessment for the project, including CalEEMod output tables.

[1] United States Environmental Protection Agency. 2018. Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES2014b . July 2018. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100UXEN.pdf.

[2] United States Department of Transportation, Bureau of Transportation Statistics. 2018. National Transportation Statistics 2018 . Available at: https://www.bts.gov/sites/bts.dot.gov/files/docs/browse-statistical-products-anddata/national-transportation-statistics/223001/ntsentire2018q4.pdf.

[3] U.S. Energy Information Administration, Energy Units and Calculations Explained, last updated June 29, 2022.

[4] California Air Resources Board, CA-GREET 2.0 Supplemental Document and Tables of Changes, Appendix C, Supplement to the LCFS CA-GREET 2.0 Model, 12/15/2014 , page C-24, Table 10. Available at: https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/lcfs15appc.pdf

[5] California Air Resources Board (CARB), EMFAC2021 v1.0.0., 2021. Available at https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools-emfac-software-and

[6] Anticipated TDM reduction information is from the the project-specific CEQA Transportation Analysis.

Acronyms used include:

Btu = British Thermal Units
hrs = hours
kBtu = Thousand British Thermal Units
kWH = kilowatt hours
MMBtu = Million British Thermal Units
MPG = miles per gallon
TDM = Transportation Demand Management
VMT = vehicle miles traveled