

Appendix H:
Energy Resources Supporting Information

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College Creek Apartments Project Summary Energy Use

Summary of Energy Use During Construction

(Annually)

Construction off-site vehicle fuel	32,432 gallons (gasoline, diesel)
Construction on-site equipment fuel	56,404 gallons (diesel)
<i>Total on-site and off-site construction fuel</i>	<i>88,836 gallons (gasoline, diesel)</i>
Construction office electricity	18,500 kilowatt hours

Summary of Energy Use During Operations

(Annually)

Operation vehicle fuel	56,715 gallons (gasoline, diesel)
Operation natural gas	0 kilo-British Thermal Units
Operation electricity*	709,776 kilowatt hours

*The project would achieve net zero electricity through a combination of on-site solar and the purchase of renewable electricity

Construction Vehicle Fuel Calculations

California Air Resource Board (ARB). 2019. EMFAC2014 Web Database. Website: <https://www.arb.ca.gov/emfac/2014/>. Accessed December 4, 2019.

VMT = Vehicle Miles Traveled
FE = Fuel Economy

EMFAC2014 (v1.0.7) Emissions Inventory

Region Type: County

Region: Sonoma

Calendar Year: 2021

Season: Annual

Vehicle Classification: EMFAC2007 Categories

Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Given Region	CalYr	VehClass	MdlYr	Speed	Fuel	Population	VMT	Fuel_Consumption	Calculations	
									FE (mi/gallon)	VMT*FE
Sonoma	2021	LDA	Aggregated	Aggregated	GAS	127800.6513	5124518.909	176.0277166	29.112	149184995.2
Sonoma	2021	LDA	Aggregated	Aggregated	DSL	1744.049132	66522.4195	1.85737646	35.81526	2382517.703
Sonoma	2021	LDT1	Aggregated	Aggregated	GAS	10787.93283	366089.6465	15.28725683	23.94737	8766885.439
Sonoma	2021	LDT1	Aggregated	Aggregated	DSL	24.12086989	393.8490776	0.015190621	25.92712	10211.37273
Sonoma	2021	LDT2	Aggregated	Aggregated	GAS	37609.02884	1576995.545	71.98203753	21.90818	34549104.69
Sonoma	2021	LDT2	Aggregated	Aggregated	DSL	61.94278236	2947.495638	0.101025801	29.17567	85995.16575
Sonoma	2021	MDV	Aggregated	Aggregated	GAS	30063.48209	995008.243	62.82762792	15.83711	15758057.98
Sonoma	2021	MDV	Aggregated	Aggregated	DSL	429.5000675	18671.04892	0.848846587	21.99579	410684.4192
Sonoma	2021	LHDT1	Aggregated	Aggregated	GAS	3740.693587	110465.2031	11.55172881	9.562656	1056340.683
Sonoma	2021	LHDT1	Aggregated	Aggregated	DSL	4692.502384	152622.8949	8.910520906	17.12839	2614184.771
Sonoma	2021	LHDT2	Aggregated	Aggregated	GAS	518.3351583	18866.9752	2.158259728	8.741754	164930.4524
Sonoma	2021	LHDT2	Aggregated	Aggregated	DSL	1142.216547	43547.78601	2.801706884	15.54331	676876.5416
Sonoma	2021	MHDT	Aggregated	Aggregated	GAS	329.7546429	15106.22661	2.391642459	6.316256	95414.79808
Sonoma	2021	MHDT	Aggregated	Aggregated	DSL	4906.573775	256968.217	30.90363593	8.315145	2136728.012
Sonoma	2021	HHDT	Aggregated	Aggregated	GAS	16.2357747	1901.587823	0.413152808	4.602626	8752.297397
Sonoma	2021	HHDT	Aggregated	Aggregated	DSL	1990.657711	245931.739	43.4813758	5.656025	1390996.01
Worker Trips										
Sum of VMT*FE										211148452
Total VMT										8151147.157
Weighted Average FE										25.90413937 miles/gallon
Vendor										
Sum of VMT*FE										8144223.564
Total VMT										845410.6297
Weighted Average FE										9.633452997 miles/gallon
Haul										
Sum of VMT*FE										1399748.307
Total VMT										247833.3268
Weighted Average FE										5.647942208 miles/gallon

Construction Assumptions

Source: AQ/GHG Appendix

ON-SITE:

Trips and VMT	Trips per Day		Total Trips	Trips per Phase				VMT per Phase			Fuel Consumption (gallons)					
	Worker			Worker		Vendor		Worker	Vendor	Hauling	Worker	Vendor	Hauling			
	Trip Number	Vendor Trip Number		Trip Length	Vendor Trip Length	Hauling Trip Length	Trip Number							Trip Number	Hauling Trip Number	Trips
Phase Name	Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Num Days	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trips	Vendor Trips	Hauling Trips	Worker Trips	Vendor Trips	Hauling Trips
Demolition	15	0	836	10.8	7.3	20	29	435	0	836	4,698	0	16,720	181.36	0.00	2,960.37
Site Preparation	18	0	225	10.8	7.3	20	10	180	0	225	1,944	0	4,500	75.05	0.00	796.75
Grading	15	0	0	10.8	7.3	20	120	1,800	0	0	19,440	0	0	750.46	0.00	0.00
Building Construction	178	40	0	10.8	7.3	20	260	46,280	10,400	0	499,824	75,920	0	19,295.14	7,880.87	0.00
Architectural Coating	36	0	0	10.8	7.3	20	20	720	0	0	7,776	0	0	300.18	0.00	0.00
Paving	15	0	0	10.8	7.3	20	22	330	0	0	3,564	0	0	137.58	0.00	0.00

Total Construction VMT (miles)
634,386

Total Fuel Consumption (gallons)
32,378

OFF-SITE:

Trips and VMT	Trips per Day		Total Trips	Trips per Phase				VMT per Phase			Fuel Consumption (gallons)					
	Worker			Worker		Vendor		Worker	Vendor	Hauling	Worker	Vendor	Hauling			
	Trip Number	Vendor Trip Number		Trip Length	Vendor Trip Length	Hauling Trip Length	Trip Number							Trip Number	Hauling Trip Number	Trips
Phase Name	Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Num Days	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trips	Vendor Trips	Hauling Trips	Worker Trips	Vendor Trips	Hauling Trips
Site Preparation	5	0	0	10.8	7.3	20	2	10	0	0	108	0	0	4.17	0.00	0.00
Grading	10	0	0	10.8	7.3	20	3	30	0	0	324	0	0	12.51	0.00	0.00
Paving	18	0	0	10.8	7.3	20	5	90	0	0	972	0	0	37.52	0.00	0.00

Total Construction VMT (miles)
1,404

Total Fuel Consumption (gallons)
54

Total Construction:

Total Construction VMT (miles) ON-SITE + OFF-SITE
635,790

Total Fuel Consumption (gallons) ON-SITE + OFF-SITE
32,432

Construction Equipment Fuel Calculation

OffRoad Equipment ON-SITE

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor	Number of Days	HP Hours	Diesel Fuel Usage
Demolition	Concrete/Industrial Saws	1	8	81	0.73	29	13,718.16	685.91
Demolition	Excavators	3	8	158	0.38	29	41,787.84	2,089.39
Demolition	Rubber Tired Dozers	2	8	247	0.4	29	45,843.20	2,292.16
Site Preparation	Rubber Tired Dozers	3	8	247	0.4	10	23,712.00	1,185.60
Site Preparation	Tractors/Loaders/Backhoes	4	8	97	0.37	10	11,484.80	574.24
Grading	Excavators	1	8	158	0.38	120	57,638.40	2,881.92
Grading	Graders	1	8	187	0.41	120	73,603.20	3,680.16
Grading	Rubber Tired Dozers	1	8	247	0.4	120	94,848.00	4,742.40
Grading	Tractors/Loaders/Backhoes	3	8	97	0.37	120	103,363.20	5,168.16
Building Construction	Cranes	1	7	231	0.29	260	121,921.80	6,096.09
Building Construction	Forklifts	3	8	89	0.2	260	111,072.00	5,553.60
Building Construction	Generator Sets	1	8	84	0.74	260	129,292.80	6,464.64
Building Construction	Tractors/Loaders/Backhoes	3	7	97	0.37	260	195,959.40	9,797.97
Building Construction	Welders	1	8	46	0.45	260	43,056.00	2,152.80
Paving	Pavers	2	8	130	0.42	22	19,219.20	960.96
Paving	Paving Equipment	2	8	132	0.36	22	16,727.04	836.35
Paving	Rollers	2	8	80	0.38	22	10,700.80	535.04
Architectural Coating	Air Compressors	1	6	78	0.48	20	4,492.80	224.64
Total Construction Equipment Fuel Consumption								55,922.03 gallons

OffRoad Equipment OFF-SITE

Site Preparation	Graders	1	8	187	0.41	2	1,226.72	61.34
Site Preparation	Tractors/Loaders/Backhoes	1	8	97	0.37	2	574.24	28.71
Grading	Concrete/Industrial Saws	1	8	81	0.73	3	1,419.12	70.96
Grading	Rubber Tired Dozers	1	1	247	0.4	3	296.40	14.82
Grading	Tractors/Loaders/Backhoes	2	6	97	0.37	3	1,292.04	64.60
Paving	Cement and Mortar Mixers	4	6	9	0.56	5	604.80	30.24
Paving	Pavers	1	7	130	0.42	5	1,911.00	95.55
Paving	Rollers	1	7	80	0.38	5	1,064.00	53.20
Paving	Tractors/Loaders/Backhoes	1	7	97	0.37	5	1,256.15	62.81
Total Construction Equipm								482.22 gallons
Total On-site + Off-site								56,404.26 gallons

Notes:

Equipment assumptions are consistent with those used to estimate GHG emissions (see CalEEMod output files).
 Fuel usage estimate of 0.05 gallons of diesel fuel per horsepower-hour is from the SCAQMD CEQA Air Quality Handbook, Table A9-3E.
 South Coast Air Quality Management District. 1993. Air Quality Handbook, Table A9-3E.
 Website: <http://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook>. Accessed December 4, 2019.

Construction Schedule

On-site:
 College Creek Apartments Unmitigated Construction and Operational Run (On-Site) - Sonoma-San Francisco County, Annual
 Date: 12/3/2019 11:28 PM

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days	Num Days	Phase Description
1	Demolition	Demolition	7/20/2021	8/27/2021	5	29	
2	Site Preparation	Site Preparation	8/28/2021	9/10/2021	5	10	
3	Grading	Grading	9/11/2021	2/25/2022	5	120	
4	Building Construction	Building Construction	12/30/2021	12/28/2022	5	260	
5	Paving	Paving	8/1/2022	8/30/2022	5	22	
6	Architectural Coating	Architectural Coating	12/1/2022	12/28/2022	5	20	

Off-site:

Multipurpose Creek Trail - Unmitigated Construction Run - Sonoma-San Francisco County, Annual
 Date: 12/3/2019 11:19 PM

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days	Num Days	Phase Description
1	Site Preparation	Site Preparation	10/14/2021	10/15/2021	5	2	
2	Grading	Grading	10/16/2021	10/20/2021	5	3	
3	Paving	Paving	10/19/2021	10/25/2021	5	5	

Construction Office Electricity Calculation

Energy Appendix: CalEEMod Typical Construction Trailer
 Typical Construction Trailer - Sonoma-San Francisco County, Annual
 Date: 12/5/2019 8:41 AM

5.3 Energy by Land Use - Electricity
Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	12837.6	2.2748	1.7000e-004	3.0000e-005	2.2894
Total		2.2748	1.7000e-004	3.0000e-005	2.2894

kWh/yr = kilowatt hours per year

Energy by Land Use - Electricity

Annual 12,837.6 kWh/yr
Total Over Construction 18,500.213 kWh

Total Construction Schedule

Start 7/20/2021
 End 12/28/2022
 Total Calendar Days 526
 Years 1.44

Operation Fuel Calculation

California Air Resource Board (ARB). 2019. EMFAC2014 Web Database. Website: <https://www.arb.ca.gov/emfac/2014/>. Accessed December 4, 2019.

EMFAC2014 (v1.0.7) Emissions Inventory

VMT = Vehicle Miles Traveled

Region Type: County

FE = Fuel Economy

Region: Sonoma

Calendar Year: 2022

Season: Annual

Vehicle Classification: EMFAC2007 Categories

Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption

Given

Calculations

Region	CalYr	VehClass	MdYr	Speed	Fuel	Population	VMT	Fuel Consumption	FE	VMT*FE
Sonoma	2022	HHDT	Aggregated	Aggregated	GAS	15.8160633	1903.04562	0.407845158	4.666098	8879.798067
Sonoma	2022	HHDT	Aggregated	Aggregated	DSL	2030.51599	254471.499	44.31620321	5.742177	1461220.48
Sonoma	2022	LDA	Aggregated	Aggregated	GAS	129762.049	5181495.69	172.7982382	29.98581	155371362
Sonoma	2022	LDA	Aggregated	Aggregated	DSL	1790.57515	67918.1917	1.841196676	36.88807	2505371.004
Sonoma	2022	LDT1	Aggregated	Aggregated	GAS	10267.7366	353086.284	14.22716333	24.81776	8762809.64
Sonoma	2022	LDT1	Aggregated	Aggregated	DSL	22.5569319	366.448836	0.013829619	26.49739	9709.938192
Sonoma	2022	LDT2	Aggregated	Aggregated	GAS	37320.9484	1571258.79	69.06890282	22.74915	35744801.15
Sonoma	2022	LDT2	Aggregated	Aggregated	DSL	65.3097779	3051.26416	0.10146854	30.07104	91754.67622
Sonoma	2022	LHDT1	Aggregated	Aggregated	GAS	3488.62478	101413.189	10.58318969	9.582479	971789.7171
Sonoma	2022	LHDT1	Aggregated	Aggregated	DSL	4473.0435	143272.275	8.327683612	17.20434	2464904.507
Sonoma	2022	LHDT2	Aggregated	Aggregated	GAS	490.910667	17874.0629	2.033675146	8.789045	157095.9484
Sonoma	2022	LHDT2	Aggregated	Aggregated	DSL	1103.69285	41879.0174	2.672712003	15.66911	656206.9153
Sonoma	2022	MCY	Aggregated	Aggregated	GAS	7359.37047	48258.3712	1.369874825	35.22831	1700060.73
Sonoma	2022	MDV	Aggregated	Aggregated	GAS	29235.7663	967735.198	59.24591279	16.33421	15807190.23
Sonoma	2022	MDV	Aggregated	Aggregated	DSL	452.95505	19299.5514	0.851327825	22.66994	437519.6887
Sonoma	2022	MH	Aggregated	Aggregated	GAS	882.512605	7460.8163	1.134692676	6.575187	49056.26078
Sonoma	2022	MH	Aggregated	Aggregated	DSL	252.72313	2244.65635	0.234510848	9.571653	21485.07066
Sonoma	2022	MHDT	Aggregated	Aggregated	GAS	323.131106	15060.2054	2.365350197	6.367009	95888.45934
Sonoma	2022	MHDT	Aggregated	Aggregated	DSL	5161.59589	264991.876	31.7467638	8.347052	2211900.866
Sonoma	2022	OBUS	Aggregated	Aggregated	GAS	149.4559	7885.02111	1.201316346	6.563651	51754.52581
Sonoma	2022	OBUS	Aggregated	Aggregated	DSL	269.553963	21181.7908	2.907320218	7.285675	154323.6485
Sonoma	2022	SBUS	Aggregated	Aggregated	GAS	22.856429	1175.33921	0.098380937	11.94682	14041.56453
Sonoma	2022	SBUS	Aggregated	Aggregated	DSL	185.381176	7039.51683	0.970259399	7.255294	51073.7615
Sonoma	2022	UBUS	Aggregated	Aggregated	GAS	51.1875328	7479.90114	1.504529238	4.971589	37186.99491
Sonoma	2022	UBUS	Aggregated	Aggregated	DSL	62.7304963	9052.2076	2.03754561	4.442702	40216.2592

Vehicles	
Sum of VMT*FE	228877603.9
Total VMT	9116854.217
Weighted Average FE	25.10488798 miles/gallon

Total VMT

Source: AQ/GHG Appendix, CalEEMod Output

College Creek Apartments Unmitigated Construction and Operational Run (On-Site) - Sonoma-San Francisco County, Annual

Date: 2/2/2020 9:55 PM

4.2 Trip Summary Information

Land Use	Average Daily Trip Rate			Unmitigated	Mitigated
	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Mid Rise	913.92	913.92	913.92	1,423,814	1,423,814
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Recreational Swimming Pool	0.00	0.00	0.00		
Total	913.92	913.92	913.92	1,423,814	1,423,814

	VMT	Fuel Consumption
Vehicles	1,423,814	56,715
Total	1,423,814	56,715

Total VMT	1,423,814 miles
Fuel consumption	56,715 gallons per year

Operation Electricity Use

Source: AQ/GHG Appendix, CalEEMod Output

College Creek Apartments Unmitigated Construction and Operational Run (On-Site) - Sonoma-San Francisco County, Annual

Date: 2/2/2020 9:55 PM

kWh/yr = kilowatt hours per year

Unmitigated Electricity Use		
Land Use	(kWh/yr)	
Apartments Mid Rise	693563	
Parking Lot	16213.4	
Other Asphalt Surfaces	0	
Other Non-Asphalt Surfaces	0	
Recreational Swimming Pool	0.00	
Total Unmitigated	709,776 kWh/yr	

Mitigated Electricity Use		
Land Use	(kWh/yr)	
Apartments Mid Rise	0	
Parking Lot	0	
Other Asphalt Surfaces	0	
Other Non-Asphalt Surfaces	0	
Recreational Swimming Pool	0.00	
Total Unmitigated	0 kWh/yr	

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	Mt/yr			
Apartments Mid Rise	693563	122.8965	9.1200e-003	1.8900e-003	123.6870
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	16213.4	2.8730	2.1000e-004	4.0000e-005	2.8914
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000
Total		125.7694	9.3300e-003	1.9300e-003	126.5785

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	Mt/yr			
Apartments Mid Rise	0	0.0000	0.0000	0.0000	0.0000
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Recreational Swimming Pool	0	0.0000	0.0000	0.0000	0.0000
Total		0.0000	0.0000	0.0000	0.0000

Typical Construction Trailer - Sonoma-San Francisco County, Annual

Typical Construction Trailer Sonoma-San Francisco County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	0.72	1000sqft	0.02	720.00	0

1.2 Other Project Characteristics

Urbanization	Urban	Wind Speed (m/s)	2.2	Precipitation Freq (Days)	75
Climate Zone	4			Operational Year	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	390.65	CH4 Intensity (lb/MWhr)	0.029	N2O Intensity (lb/MWhr)	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Typical construction trailer for estimate of energy usage
CO2 intensity factor adjusted based on Renewable Portfolio Standard

Land Use - 12'x60' single-wide unit (720 sq ft)

Construction Phase - Typical construction trailer for energy use estimates - estimates would be included in the operational component of the results

Off-road Equipment - Zeroed out construction equipment

Table Name	Column Name	Default Value	New Value
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	0.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	390.65
tblVehicleTrips	ST_TR	2.46	0.00
tblVehicleTrips	SU_TR	1.05	0.00
tblVehicleTrips	WD_TR	11.03	0.00

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	2.2748	2.2748	1.7000e-004	3.0000e-005	2.2894
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	2.2748	2.2748	1.7000e-004	3.0000e-005	2.2894
NaturalGas Mitigated	6.0000e-005	5.8000e-004	4.9000e-004	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	0.6290	0.6290	1.0000e-005	1.0000e-005	0.6327
NaturalGas Unmitigated	6.0000e-005	5.8000e-004	4.9000e-004	0.0000		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	0.6290	0.6290	1.0000e-005	1.0000e-005	0.6327

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	12837.6	2.2748	1.7000e-004	3.0000e-005	2.2894
Total		2.2748	1.7000e-004	3.0000e-005	2.2894

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	12837.6	2.2748	1.7000e-004	3.0000e-005	2.2894
Total		2.2748	1.7000e-004	3.0000e-005	2.2894

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