

Appendix D:
Energy Supporting Information

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Richmond Country Club Residential Development Project Energy Use Summary

Summary of Energy Use During Phase 1 Construction	(Annually)
Construction vehicle fuel	52,285 gallons (gasoline, diesel)
Construction equipment fuel	48,683 gallons (diesel)
Construction office electricity	8,986 kilowatt hours
Summary of Energy Use During Phase 2 Construction	(Annually)
Construction vehicle fuel	2,226 gallons (gasoline, diesel)
Construction equipment fuel	59,476 gallons (diesel)
Construction office electricity	8,986 kilowatt hours
Summary of Energy Use During Proposed Operations	(Annually)
Operation vehicle fuel	95,669 gallons (gasoline, diesel)
Operation natural gas	4,317,020 kilo-British Thermal Units
Operation electricity	366,655 kilowatt hours
Summary of Energy Use During Existing Operations	(Annually)
Operation natural gas	102,449 kilo-British Thermal Units
Operation electricity	66,144 kilowatt hours
Increase in Energy Use from Existing Operations to Proposed Operations	(Annually)
Additional operation vehicle fuel	95,669 gallons (gasoline, diesel)
Additional operation natural gas	4,214,571 kilo-British Thermal Units
Additional operation electricity	300,511 kilowatt hours

Natural gas consumption not included in AQ, GHG, or Energy analyses due to compliance with the City of Richmond's Energy Reach Code.

Richmond Country Club Residential Development - Phase 1

Last Updated: 06/16/2020

Compression-Ignition Engine Brake-Specific Fuel Consumption (BSFC) Factors ^[1] :			
HP: 0 to 100	0.0588	HP: Greater than 100	0.0529
<i>Values above are expressed in gallons per horsepower-hour/BSFC.</i>			

CONSTRUCTION EQUIPMENT ^[2]						
Construction Equipment	Quantity	Hours per		Load Factor	Construction Phase	Fuel Used (gallons) ^[A]
		Day	Horsepower			
Concrete/Industrial Saws	1	8	81	0.73	Demolition	555.96
Excavators	3	8	158	0.38	Demolition	1,523.35
Rubber Tired Dozers	2	8	247	0.40	Demolition	1,671.19
Rubber Tired Dozers	3	8	247	0.40	Site Preparation	1,253.39
Tractors/Loaders/Backhoes	4	8	97	0.37	Site Preparation	674.90
Excavators	2	8	158	0.38	Grading	1,523.35
Graders	1	8	187	0.41	Grading	972.65
Rubber Tired Dozers	1	8	247	0.40	Grading	1,253.39
Scrapers	2	8	367	0.48	Grading	4,469.59
Tractors/Loaders/Backhoes	2	8	97	0.37	Grading	1,012.34
Cranes	1	7	231	0.29	Building Construction	5,577.11
Forklifts	3	8	89	0.20	Building Construction	5,648.42
Generator Sets	1	8	84	0.74	Building Construction	6,575.01
Tractors/Loaders/Backhoes	3	7	97	0.37	Building Construction	9,965.25
Welders	1	8	46	0.45	Building Construction	2,189.55
Pavers	2	8	130	0.42	Paving	923.55
Paving Equipment	2	8	132	0.36	Paving	803.80
Rollers	2	8	80	0.38	Paving	571.66
Air Compressors	1	6	78	0.48	Architectural Coating	1,518.09

Construction Phase	Days of Operation	Total Diesel Fuel Used
Demolition	20	48,682.56 (Gallons)
Site Preparation	10	
Grading	30	
Building Construction	225	
Architectural Coating	115	
Paving	20	
Total Days	420	

WORKER TRIPS ^[2]				
Constuction Phase	MPG ^[3]	Trips	Trip Length (miles)	Fuel Used (gallons) ^[B]
Demolition	28.1	15	10.8	115.26
Site Preparation	28.1	18	10.8	69.15
Grading	28.1	20	10.8	230.51
Building Construction	28.1	126	10.8	10,891.65
Paving	28.1	15	10.8	115.26
Architectural Coating	28.1	25	10.8	1,104.53
Total Gasoline Fuel Used				12,526.36

HAULING AND VENDOR TRIPS ^[2]				
Trip Class	MPG ^[3]	Trips	Trip Length (miles)	Fuel Used (gallons) ^[C]
HAULING TRIPS				
Demolition	5.2	26	20.0	100.82
Site Preparation	5.2	3496	20.0	13,556.76
Grading	5.2	5000	20.0	19,388.95
Building Construction	5.2	0	20.0	-
Architectural Coating	5.2	0	20.0	-
Paving	5.2	0	20.0	-
Total Diesel Fuel Used				33,046.53
VENDOR TRIPS				
Demolition	11.7	0	7.3	-
Site Preparation	11.7	0	7.3	-
Grading	11.7	0	7.3	-
Building Construction	11.7	48	7.3	6,711.66
Architectural Coating	11.7	0	7.3	-
Paving	11.7	0	7.3	-
Total Diesel Fuel Used				6,711.66

Total Gasoline Consumption (gallons)	12,526.36
Total Diesel Consumption (gallons)	88,440.75

Notes:

[A] Construction Equipment Fuel Used (Formula):

Quantity * Hours per Day * Horsepower * Load Factor * Days of Operation * BSFC Factor = Total Diesel Fuel Used

[B] Worker Trips Fuel Used (Formula):

(Trips * Trip Length * Days) / MPG = Total Gasoline Fuel Used

[C] Vendor & Hauling Trips Fuel Used (Formula):

(Trips * Trip Length) / MPG = Total Diesel Fuel Used

Sources:

[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?Dockkey=P100UXEN.pdf>.

[2] CalEEMod (Version 2016.3.2) Run for Richmond Country Club - Phase 1 Construction, dated June 15, 2020.

[3] California Air Resources Board. 2020. EMFAC2017 [Interactive Database]. Website: <https://arb.ca.gov/emfac/2017/>. Accessed June 7, 2020.

Richmond Country Club Residential Development - Phase 2

Last Updated: 06/16/2020

Compression-Ignition Engine Brake-Specific Fuel Consumption (BSFC) Factors ^[1] :			
HP: 0 to 100	0.0588	HP: Greater than 100	0.0529
<i>Values above are expressed in gallons per horsepower-hour/BSFC.</i>			

CONSTRUCTION EQUIPMENT ^[2]						
Construction Equipment	Quantity	Hours per		Load	Construction Phase	Fuel Used (gallons) ^[A]
		Day	Horsepower	Factor		
Cranes	1	7	231	0.29	Building Construction	5,205.31
Forklifts	3	8	89	0.20	Building Construction	5,271.86
Generator Sets	1	8	84	0.74	Building Construction	6,136.68
Tractors/Loaders/Backhoes	3	7	97	0.37	Building Construction	9,300.90
Welders	1	8	46	0.45	Building Construction	2,043.58
Air Compressors	1	6	78	0.48	Architectural Coating	1,518.09
Pavers	2	8	130	0.42	Paving	923.55
Paving Equipment	2	8	132	0.36	Paving	803.80
Rollers	2	8	80	0.38	Paving	571.66

Construction Phase	Days of Operation	Total Diesel Fuel Used
Building Construction	210	29,476.42 (Gallons)
Architectural Coating	115	
Paving	20	
Total Days	325	

WORKER TRIPS ^[2]				
Constuction Phase	MPG ^[3]	Trips	Trip Length (miles)	Fuel Used (gallons) ^[B]
Building Construction	28.9	18	10.8	1,410.86
Architectural Coating	28.9	4	10.8	171.69
Paving	28.9	15	10.8	111.97
	28.9	0	0.0	-
	28.9	0	0.0	-
	28.9	0	0.0	-
Total Gasoline Fuel Used				1,582.55

HAULING AND VENDOR TRIPS ^[2]				
Trip Class	MPG ^[3]	Trips	Trip Length (miles)	Fuel Used (gallons) ^[C]
HAULING TRIPS				
Building Construction	5.2	0	20.0	-
Architectural Coating	5.2	0	20.0	-
Paving	5.2	0	20.0	-
	5.2	0	0.0	-
	5.2	0	0.0	-
	5.2	0	0.0	-
Total Diesel Fuel Used				-
VENDOR TRIPS				
Building Construction	11.9	5	7.3	643.12
Architectural Coating	11.9	0	7.3	-
Paving	11.9	0	7.3	-
	11.9	0	0.0	-
	11.9	0	0.0	-
	11.9	0	0.0	-
Total Diesel Fuel Used				643.12

Total Gasoline Consumption (gallons)	1,582.55
Total Diesel Consumption (gallons)	30,119.53

Notes:

[A] Construction Equipment Fuel Used (Formula):

Quantity * Hours per Day * Horsepower * Load Factor * Days of Operation * BSFC Factor = Total Diesel Fuel Used

[B] Worker Trips Fuel Used (Formula):

(Trips * Trip Length * Days) / MPG = Total Gasoline Fuel Used

[C] Vendor & Hauling Trips Fuel Used (Formula):

(Trips * Trip Length) / MPG = Total Diesel Fuel Used

Sources:

[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?Dockkey=P100UXEN.pdf>.

[2] CalEEMod (Version 2016.3.2) Run for Richmond Country Club - Phase 2 Construction, dated June 15, 2020.

[3] California Air Resources Board. 2020. EMFAC2017 [Interactive Database]. Website: <https://arb.ca.gov/emfac/2017/>. Accessed June 7, 2020.

Construction Office Electricity Calculation

Energy Appendix: CalEEMod Typical Construction Trailer
Typical Construction Trailer - Contra Costa County, Annual
Date: 6/12/2020 8:30 PM

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	8985.6	0.8559	1.2000e-004	2.0000e-005	0.8662
Total		0.8559	1.2000e-004	2.0000e-005	0.8662

kWh/yr = kilowatt hours per year

Energy by Land Use - Electricity

Annual 8,986 kWh/yr
Total Over Construction 18,414 kWh

Total Construction Schedule

Start 10/1/2021
End 10/19/2023
Total Calendar Days 748
Years 2.05

Richmond Country Club Residential Development - Full Operation

Last Updated: 06/16/2020

Populate one of the following tables (Leave the other blank):

Annual VMT ^[1]	OR	Daily Vehicle Trips ^[3]
Annual VMT: 2,223,875		Daily Vehicle Trips: Average Trip Distance:

Fleet Class	Fleet Mix ^[1]	Fuel Economy (MPG) ^[2]
Light Duty Auto (LDA)	0.586711	LDA 31.93
Light Duty Truck 1 (LDT1)	0.038259	LDT1 27.24
Light Duty Truck 2 (LDT2)	0.185486	LDT2 25.17
Medium Duty Vehicle (MDV)	0.120728	MDV 20.40
Light Heavy Duty 1 (LHD1)	0.016377	LHD1 8.38
Light Heavy Duty 2 (LHD2)	0.005053	LHD2 7.38
Medium Heavy Duty (MHD)	0.010699	T6 Public 7.50
Heavy Heavy Duty (HHD)	0.024311	T7 Public 5.16
Other Bus (OBUS)	0.001622	OBUS 4.78
Urban Bus (UBUS)	0.001773	UBUS 6.04
School Bus (SBUS)	0.002738	SBUS 8.87
Motorhome (MH)	0.000835	MH 9.86
Motorcycle (MCY)	0.005406	MCY 37.33

Fleet Mix					
Vehicle Type	Percent	Fuel Type	Annual VMT: VMT	Vehicle Trips: VMT	Fuel Consumption (Gallons) ^[A]
Light Duty Auto (LDA)		<i>Gasoline</i>	1,304,771.93	-	40,865.46
Light Duty Truck 1 (LDT1)		<i>Gasoline</i>	85,083.23	-	3,123.88
Light Duty Truck 2 (LDT2)		<i>Gasoline</i>	412,497.68	-	16,388.87
Medium Duty Vehicle (MDV)		<i>Gasoline</i>	268,483.98	-	13,162.84
Light Heavy Duty 1 (LHD1)		<i>Diesel</i>	36,420.40	-	4,343.75
Light Heavy Duty 2 (LHD2)		<i>Diesel</i>	11,237.24	-	1,523.11
Medium Heavy Duty (MHD)		<i>Diesel</i>	23,793.24	-	3,172.81
Heavy Heavy Duty (HHD)		<i>Diesel</i>	54,064.63	-	10,482.56
Other Bus (OBUS)		<i>Gasoline</i>	3,607.13	-	755.30
Urban Bus (UBUS)		<i>Diesel</i>	3,942.93	-	653.34
School Bus (SBUS)		<i>Diesel</i>	6,088.97	-	686.39
Motorhome (MH)		<i>Diesel</i>	1,856.94	-	188.33
Motorcycle (MCY)		<i>Gasoline</i>	12,022.27	-	322.01

Total Gasoline Consumption (gallons)	74,618.35
Total Diesel Consumption (gallons)	21,050.30

Notes:

[A] Fleet Mix Fuel Consumption (Formula):

([Annual VMT] OR [Vehicle Trip VMT * Average Trip Length]) * Fleet Mix / MPG = Total Fuel Consumed

Sources:

[1] California Air Resources Board (ARB). 2018. "EMFAC2017 Web Database." Website: <https://www.arb.ca.gov/emfac/2017/>. Accessed June 15, 2020.

[2] CalEEMod (Version 2016.3.2) Run for Richmond Country Club - Operation, dated June 15, 2020.

[3] Draft Report Transportation Impact Analysis for the Richmond Country Club, dated May 6, 2020.

Operation Natural Gas Use

Source: AQ/GHG Appendix, CalEEMod Output
 Richmond Country Club Residential Project
 Date: 6/16/2020 10:30 AM

Natural gas consumption not included in AQ, GHG, or Energy analyses due to compliance with the City of Richmond's Energy Reach Code.

kBTU/yr = kilo-British Thermal Units/year
 CF = cubic feet

Proposed project would be all-electric (no natural gas)

Natural Gas Use
 Single-Family Housing 4.32E+06

~~Total 4,317,020 kBTU/yr~~

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	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
Land Use	kBTU/yr	tons/yr										MT/yr					
Single Family Housing	4.31702e+006	0.0233	0.1989	0.0847	1.2700e-003		0.0161	0.0161		0.0161	0.0161	0.0000	230.3728	230.3728	4.4200e-003	4.2200e-003	231.7418
Total		0.0233	0.1989	0.0847	1.2700e-003		0.0161	0.0161		0.0161	0.0161	0.0000	230.3728	230.3728	4.4200e-003	4.2200e-003	231.7418

Proposed Operation Electricity Use

Source: AQ/GHG Appendix, CalEEMod Output
 Richmond Country Club Residential Project
 Date: 6/16/2020 10:35 AM

Project Electricity Use

kWh/yr = kilowatt hours per year

Land Use	Electricity Use (kWh/yr)
Single-Family Housing	814,214.00
Total	814,214 kWh/yr

Project would include on-site solar, see CalEEMod Note 12.

Land Use	Electricity Use (kWh/yr)
Single-Family Housing	366,655.00
Total	366,655 kWh/yr

5.3 Energy by Land Use - Electricity

Unmitigated

Land Use	Electricity Use kWh/yr	Total CO2 MT/yr	CH4 MT/yr	N2O MT/yr	CO2e MT/yr
Single Family Housing	814214	77.5575	0.0107	2.2200e-003	78.4856
Total		77.5575	0.0107	2.2200e-003	78.4856

Mitigated

Land Use	Electricity Use kWh/yr	Total CO2 MT/yr	CH4 MT/yr	N2O MT/yr	CO2e MT/yr
Single Family Housing	366655	34.9256	4.8200e-003	1.0000e-003	35.3435
Total		34.9256	4.8200e-003	1.0000e-003	35.3435

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