

Appendix C

Energy Calculations

C.1-1 Assumptions

IBC Multi-Use Trail Creekwalk
Assumptions

Project Land Uses	CalEEMod Land Use Type	CalEEMod Land Use Subtype	Amount	Unit	Building SF	Landscaping Area
Project Land Uses						
Creekwalk Trail	Parking	Other Non-asphalt surface	3.340	acre	0	0

Source:
Construction Data Form, Confirmation of acreage from Nicholas Woo on 8/14/2024

Construction Phase	CalEEMod Phase Type	Start Date	End Date	Workdays (\$ days/week)	Worker Vehicles/Day	Workers Trips (In/Out)/Day	Total Debris or Concrete Amount	Daily Debris or Concrete Amount	Total Haul (or Concrete) Trips (In/Out)	Total Haul (or Concrete) Trucks/Day	Haul (or Concrete) Trips/Day (In/Out)	Days of Hauling	Vendor Truck trips/day
Demolition	Demolition	1/1/2028	6/30/2028	130	5	10	6,288	49	1,258	5	10	130	2
Site Grading	Grading	7/1/2028	9/12/2028	52	3	6	5,670	110	1,134	11	22	52	2
Asphalt Paving	Paving	9/13/2028	2/2/2029	117	10	20	5,390	47	1,080	5	10	117	
Concrete Paving	Trenching	9/13/2028	10/10/2028	20	0	0	265	14	54	2	4	20	
Total Work Days				299									

Demolition Quantities

Parameters	Amount	Notes/Comments
Total		
Building Area (ft ²)	0	
Building Volume (ft ³)	0	
Building and Hardscape Waste Volume (CY) ¹	0	
Building Waste weight (tons) ²	0	
Hardscape		
Hardscape Area (ft ²)	145,490	
Thickness (ft)	1.167	Roadside Management Toolbox: Asphalt Concrete
Hardscape Debris Volume (CY)	6,288	
Debris weight (lb)/Volume (CY) ²	2400	
Hardscape Debris Weight (tons)	7,546	
Total Debris Weight (tons)	7,546	
Total Demolition Debris (CY)	6,288	
Haul Truck Capacity (CY)	10	
Total Haul Trucks Required	629	
Total Haul Truck Trips (In/Out)	1,258	
Days of Hauling³	130	
Total Haul Truck Trips (In/Out) per day	10	

Paving

Parameters	Amount
Asphalt	
Asphalt Site Area (acres) ²	2.04
Site Area (ft ²)	88,950
Footings Depth (ft) ⁴	1.00
Total Asphalt Volume (CY) ¹	3,294
Asphalt Truck Capacity (CY)	10
Total Trucks Required ²	330
Total Truck Trips (In/Out)	660
Days of Asphalt Delivery	117
Max Truck Trips (In/Out) per Day	6

Provided by BFK Engineers
Provided by BFK Engineers
Provided by BFK Engineers, Aggregate Base and Asphalt

Site Grading Quantities

Parameters	Amount
Material(Export) (CY) ¹	5,670
Haul Truck Capacity (CY)	10
Total Haul Trucks Required	567
Total Haul Truck Trips (In/Out)	1,134
Days of Hauling³	52
Daily Haul Amount (CY)	110
Total Haul Truck Trips (In/Out) per day	22

Decomposed Granite(DG) Material

DG	Amount
DG Site Area (acres) ²	1.30
Site Area (ft ²)	56,575
Footings Depth (ft) ⁴	1.00
Total DG Volume (CY) ¹	2,095
DG Truck Capacity (CY)	10
Total Trucks Required ²	210
Total Truck Trips (In/Out)	420
Days of DG Delivery	117
Max Truck Trips (In/Out) per Day	4

Provided by BFK Engineers
Provided by BFK Engineers
Provided by BFK Engineers

Foundations/Concrete Quantities (Building Construction)

Foundations	Amount
Site Area (acres) ²	
Site Area (ft ²)	
Footings Depth (ft) ⁴	
Total Concrete Volume (CY) ¹	265
Concrete Truck Capacity (CY)	10
Total Concrete Trucks Required ²	27
Total Concrete Truck Trips (In/Out)	54
Days of Concrete Delivery	20
Max Concrete Truck Trips (In/Out) per Day	4

*We assume it takes 20 days

Notes:
1 Construction data needs and data responses from client

Conservatively assumes that waste was disposed
50 miles roundtrip (48.6 miles), to and from Prisma
2 Deshecha Landfill / OC Waste & Recycling

Off-Road Heavy-Duty Construction Equipment - Maximum Day

Construction Phase	CalEEMod Equipment Category	No. of Heavy-Duty Equipment	No. of hours/day	Hours of Operation/Week Per Equipment	Emissions Tier Rating or Fuel (After Mitigation if needed)	Notes/Comments
Demolition	Crushing/Processing Equip.	2	8	40	Average	*Diesel Equip used, Load, HP, and emission factor taken from CalEEMod 2020 Appendix D. Modeled separately due to caleemod error where it did not calculate the emissions.
	Excavators	2	8	40	Average	
Site Grading	Graders	2	8	40	Average	
Asphalt Paving	Cement/Mortar Mixers	2	8	40	Average	
	Pavers	2	8	40	Average	
	Paving Equipment	2	8	40	Average	
	Rollers	2	8	40	Average	
	Pumps	2	8	40	Average	
Concrete Paving						

Notes: Construction Equipment identified in the Project's Construction Assumptions document

C.1-2 Construction Energy Calculations and Modeling

**IBC Multi-Use Trail Creekwalk
Construction Energy Analysis**

Annual Fuel Summary

Heavy-Duty Construction Equipment	
22,198	Total Project Consumption
19,383	Annual Consumption
Haul Trucks	
14,613	Total Project Consumption
12,760	Annual Consumption
Vendor Trucks	
499	Total Project Consumption
435	Annual Consumption
Workers	
2,478	Total Project Consumption
2,164	Annual Consumption
15,112	Project Consumption of diesel for Haul Trucks and Vendors
13,196	Annual Consumption
37,309	Total Gallons Diesel
2,478	Total Gallons Gasoline

1.15 Estimated Project Construction Duration (years)

32,579 Annual Average Gallons Diesel
2,164 Annual Average Gallons Gasoline

Orange County			Percent of Annual Project Compared to Orange County
Source	Fuel Type	Gallons	
Workers	Gasoline	1,176,000,000	0.0002%
Off-Road/Vendor/Haul Trucks	Diesel	103,800,000	0.0314%

Notes:

1 Gasoline and diesel amounts from CEC, 2023. Available: <https://www.energy.ca.gov/data-reports/energy-almanac/transportation-energy/california-retail-fuel-outlet-annual-reporting>

Annual Electricity Summary

Temporary Construction Trailer - Electricity 40,936 kWh/year
Water Conveyance for Dust Control 10,840 kWh/year
Total 51,776 kWh/year

79,256,000,000 | Total SCE, 2023
0.00000007% Project percentage of SCE

IBC Multi-Use Trail Creekwalk
 Electricity Use from Water Conveyance for Dust Control

Site	Source	Acreage/Day	Number of Days	Total Construction Water Use (Mgal)	Electricity Demand from Water Conveyance (MWh)	Annual Electricity Demand from Water Conveyance (MWh)
Project Site	Demolition	3.34	130	1.303	8.9	7.7
Project Site	Site Grading	3.34	52	0.521	3.5	3.1
Total				1.824	12.4	10.8

CalEEMod Water Electricity Factors	Electricity Intensity Factor To Supply (kWh/Mgal)	Electricity Intensity Factor To Treat (kWh/Mgal)	Electricity Intensity Factor To Distribute (kWh/Mgal)	Electricity Intensity Factor For Wastewater Treatment (kWh/Mgal)
	3044	725	1537	1501

Sources and Assumptions:

CalEEMod Appendix G, Table G-32

-Electricity Intensity Factors - California Emissions Estimator Model (CalEEMod).

-Estimated construction water use assumed to be generally equivalent to landscape irrigation, based on a factor of 20.94 gallons per year per square foot of landscaped area within the Los Angeles area (Mediterranean climate), which assumes high water demand landscaping materials and an irrigation system efficiency of 85%. Factor is therefore $(20.94 \text{ GAL/SF/year}) \times (43,560 \text{ SF/acre}) / (365 \text{ days/year}) / (0.85) = 2,940 \text{ gallons/acre/day}$, rounded up to 3,000 gallons/acre/day. (U.S. Department of Energy, Energy Efficiency & Renewable Energy, Federal Energy Management Program. "Guidelines for Estimating Unmetered Landscaping Water Use." July 2010. Page 12, Table 4 - Annual Irrigation Factor – Landscaped Areas with High Water Requirements).

**IBC Multi-Use Trail Creekwalk
Construction Energy Analysis**

Temporary Construction Trailer - Electricity

Land Use	Square Feet	Energy Use per year (kWh)	Total Energy Use (kWh)	Energy Use per SF
General Office	2,000	40,936	46,880.36	20.5

Note: Energy use per sf is derived from CalEEMod User Guide, Appendix G, Table G-28 for the Statewide average for General Office Building land use

IBC Multi-Use Trail Creekwalk
 Construction Energy Analysis
 Off-Road Equipment

Equipment ≤ 100 hp
 pounds diesel fuel/hp-hr (lb/hp-hr):² 0.408 lb/hp-hr
 diesel density (lb/gal):¹ 7.11 lb/gal
 diesel gallons/hp-hr: 0.0574 gal/hp-hr
 Total hp-hr: 341,353 hp-hr
 Total diesel gallons: 19,591 gal

Equipment > 100 hp
 pounds diesel fuel/hp-hr (lb/hp-hr):¹ 0.367 lb/hp-hr
 diesel density (lb/gal):¹ 7.11 lb/gal
 diesel gallons/hp-hr: 0.0516 gal/hp-hr
 Total hp-hr: 50,486 hp-hr
 Total diesel gallons: 2,606 gal

Total diesel gallons (off-road equipment): 22,198 gal

[1. OFFROAD2017 Emission Factor Documentation](#)

Construction Phase	Equipment	Fuel Type	Number	Hours/Day	HP	Load	Days	Total hp-hr
Demolition	Excavators	Diesel	2	8	36	0.38	130	28,454
Demolition	Crushing/Proc. Equipment	Diesel	2	8	85	0.78	130	137,904
Site Grading	Graders	Diesel	2	8	148	0.41	52	50,486
Asphalt Paving	Pavers	Diesel	2	8	81	0.42	117	63,685
Asphalt Paving	Paving Equipment	Diesel	2	8	89	0.36	117	59,979
Asphalt Paving	Rollers	Diesel	2	8	36	0.38	117	25,609
Asphalt Paving	Cement and Mortar Mixers	Diesel	2	8	10	0.56	117	10,483
Asphalt Paving	Pumps	Diesel	2	8	11	0.74	117	15,238
							Total - >100 hp	50,486
							Total - <100 hp	341,353

IBC Multi-Use Trail Creekwalk Segment
Total On-Road Fuel Consumption

gal/mile		
2028	Hauling Hauling	0.15847566
2028	Vendor Vendor	0.13432209
2028	Worker Worker	0.03400426
2029	Hauling Hauling	0.15620441
2029	Vendor Vendor	0.13292736
2029	Worker Worker	0.0334204

Construction Phase	Daily One-Way Trips	Haul Days per Phase (days)	Work Hours per Day (hours/day)	One-Way Trip Distance per Day (miles)	Idling per Day (minutes)	Regional Emissions (gallons)		
						gal/mile	gal/day	Total Gallons/yr
Demolition								
	2028							
Hauling	10	130	8	25	15	0.16	40	5,150
Vendor	2	130	8	10.2	15	0.13	3	356
Worker	10	130	8	18.5	0	0.03	6	818
Site Grading								
	2028							
Hauling	22	52	8	25	15	0.16	87	4,532
Vendor	2	52	8	10.2	15	0.13	3	142
Worker	6	52	8	18.5	0	0.03	4	196
Asphalt Paving								
	2028							
Hauling	10	78	8	25	15	0.16	40	3,090
Vendor	0	78	8	10.2	15	0.13	0	0
Worker	20	78	8	18.5	0	0.03	13	981
Asphalt Paving								
	2029							
Hauling	10	39	8	25	15	0.16	39	1,523
Vendor	0	39	8	10.2	15	0.13	0	0
Worker	20	39	8	18.5	0	0.03	12	482
Concrete Paving								
	2028							
Hauling	4	20	8	25	15	0.16	16	317
Vendor	0	20	8	10.2	15	0.13	0	0
Worker	0	20	8	18.5	0	0.03	0	0

Source	Fuel Type	Total Fuel Use (gal)
Hauling	Diesel	14,613
Vendor	Diesel	499
Worker	Gasoline	2,478
Fuel Type	Total Fuel Use	Annual Fuel Use
Diesel	15,112	13,196
Gasoline	2,478	2,164

Duration of Construction	
End	2/22/2029
1.1	years

