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# **Appendix I**

## Energy Calculations

# LVRAS Project - Segment 1

Last Updated: October 28, 2021

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>	

MPG [2]	
Worker Trips	24.4
Other Trucks	7.5

Phase	Source	Class	HP	Fuel	Load Factor	Quantity	Hours/Day	On-road Miles Per Day [3]	Daily Fuel Consumption (gallons)	Number of Days	Total Fuel Consumption (gallons)
Install Trench	1-Ton Truck, 4x4	Truck1	300	Gas	1.00	2	8	280	2100	30	63000
Install Trench	Compressor Trailer	AirCompressors	60	Diesel	0.48	1	6	0	10	30	305
Install Trench	Backhoe/Front Loader	Tractors/Loaders/Backhoes	200	Diesel	0.37	1	6	0	23	30	794
Install Trench	Dump Truck	Truck2	350	Diesel	1.00	2	6	230	1725	30	51750
Install Trench	Flatbed Truck	Truck2	350	Diesel	1.00	1	4	180	1350	13	17550
Install Trench	Water Truck	Truck1	300	Diesel	1.00	1	6	230	1725	30	51750
Install Trench	Worker Trips	Nontruck	150	Gas	1.00	6	2	130	3172	10	31720
Install Underground Cable	1-Ton Truck, 4x4	Truck1	250	Diesel	1.00	1	8	280	2100	10	21000
Install Underground Cable	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	3	6	0	74	10	737
Install Underground Cable	Wire Truck/Trailer	Nontruck	10	Gas	1.00	1	6	390	9516	10	95160
Install Underground Cable	Worker Trips	Nontruck	150	Gas	1.00	6	2	130	3172	10	31720
Install Overhead Cable	1-Ton Truck, 4x4	Truck1	250	Diesel	1.00	1	8	280	2100	75	157500
Install Overhead Cable	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	3	6	0	74	75	5530
Install Overhead Cable	Wire Truck/Trailer	Nontruck	10	Gas	1.00	1	6	390	9516	75	713700
Install Overhead Cable	Worker Trips	Nontruck	150	Gas	1.00	6	2	130	3172	10	31720

TOTAL - Segment 1	
Gasoline (gallons)	967,020
Diesel (gallons)	306,826

**Notes:**

- [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. 2019. *National Transportation Statistics 2019*. Available at: <https://www.bts.gov/topics/national-transportation-statistics>.
- [3] Assumed all on-road vehicles are traveling at an average speed of 65 miles per hour for two hours each day for commutes and the remaining hours of operation are at an average speed of 25 miles per hour as vehicles move around the work areas.

## LVRAS Project - Segment 2

Last Updated: October 28, 2021

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>	

MPG [2]	
Worker Trips	24.4
Other Trucks	7.5

Phase	Source	Class	HP	Fuel	Load Factor	Quantity	Hours/Day	On-road Miles Per Day [3]	Daily Fuel Consumption (gallons)	Number of Days	Total Fuel Consumption (gallons)
Survey	1-Ton Truck	Truck1	300	Gas	1	2	10	338	247.9	14	3469.0
Survey	Worker Trips	Nontruck	150	Gas	1	2	2	138	317.2	14	4440.8
Construction Yard	1-Ton Truck	Truck1	300	Gas	1	1	4	188	135.0	26	3537.0
Construction Yard	R/T Forklift	RoughTerrainForklifts	125	Diesel	0.4	1	4	4	1	26	277.0
Construction Yard	Water Truck	Truck1	300	Diesel	1	1	10	338	247.9	26	6484.5
Construction Yard	Worker Trips	Nontruck	150	Gas	1	2	2	138	317.2	26	8310.6
R/W Clearing	1-Ton Truck	Truck1	300	Gas	1	2	8	288	210.0	2	5670.0
R/W Clearing	Backhoe/Front Loader	Tractors/Loaders/Backhoes	125	Diesel	0.37	1	4	4	14	2	38.0
R/W Clearing	Track Type Dozer	CrawlerTractors	150	Diesel	0.43	1	4	4	20	2	55.0
R/W Clearing	Motor Grader	Graders	250	Diesel	0.41	1	4	4	33	2	87.0
R/W Clearing	Water Truck	Truck1	300	Diesel	1	1	10	338	247.9	2	6682.0
R/W Clearing	Worker Trips	Nontruck	150	Gas	1	6	2	138	317.2	2	8564.0
Guard Structure Installation	1-Ton Truck	Truck1	300	Gas	1	2	8	288	210.0	4	1890.0
Guard Structure Installation	Compressor Trailer	AirCompressors	60	Diesel	0.48	1	4	4	1	4	6.0
Guard Structure Installation	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	1	8	0	3	4	29.0
Guard Structure Installation	Boom/Crane Truck	Cranes	350	Diesel	0.24	1	4	0	4	4	36.0
Guard Structure Installation	Worker Trips	Nontruck	150	Gas	1	3	2	138	317.2	4	1268.8
LST Steel Haul	1-Ton Truck	Truck1	300	Gas	1	1	8	288	210.0	3	210.0
LST Steel Haul	R/T Forklift	RoughTerrainForklifts	125	Diesel	0.4	1	4	4	1	1	1.0
LST Steel Haul	Stake Bed Truck	Truck2	350	Diesel	1	1	8	288	210.0	3	210.0
LST Steel Haul	Worker Trips	Nontruck	150	Gas	1	2	2	138	317.2	3	317.2
LST Retrofit	1-Ton Truck	Truck1	300	Gas	1	2	8	288	210.0	3	1050.0
LST Retrofit	Compressor Trailer	AirCompressors	60	Diesel	0.48	1	4	4	1	4	6.0
LST Retrofit	R/T Forklift	RoughTerrainForklifts	125	Diesel	0.4	1	4	4	1	1	5.0
LST Retrofit	R/T Crane	Cranes	215	Diesel	0.25	1	8	0	2	3	13.0
LST Retrofit	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	1	8	0	3	3	34.0
LST Retrofit	Worker Trips	Nontruck	150	Gas	1	8	2	138	317.2	3	1586.6
LST Peak Modification	1-Ton Truck	Truck1	300	Gas	1	3	4	188	135.0	3	1089.0
LST Peak Modification	Compressor Trailer	AirCompressors	60	Diesel	0.48	1	4	4	1	3	10.0
LST Peak Modification	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	1	8	0	3	3	26.0
LST Peak Modification	Worker Trips	Nontruck	150	Gas	1	8	2	138	317.2	8	2537.8
Remove Existing GW and Install OPGW Total	1-Ton Truck	Truck1	300	Gas	1	4	8	288	210.0	13	2730.0
Remove Existing GW and Install OPGW Total	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	2	8	0	6	13	85.2
Remove Existing GW and Install OPGW Total	R/T Crane	Cranes	215	Diesel	0.25	1	6	0	2	13	25.7
Remove Existing GW and Install OPGW Total	Stake Bed Truck	Truck1	350	Diesel	1	1	8	288	210.0	13	2730.0
Remove Existing GW and Install OPGW Total	Bull Wheel Puller	OtherConstructionEquipment	350	Diesel	0.42	1	4	4	6	13	40.4
Remove Existing GW and Install OPGW Total	Wire Truck/Tensioner	Truck2	350	Diesel	1	3	2	288	210.0	6	1365.0
Remove Existing GW and Install OPGW Total	R/T Forklift	RoughTerrainForklifts	125	Diesel	0.4	1	4	4	1	6	68.0
Remove Existing GW and Install OPGW Total	D8 Cat	CrawlerTractors	350	Diesel	0.43	1	2	4	14	6	103.0
Remove Existing GW and Install OPGW Total	Hughes 500 E Helicopter [4]	Jet A	#N/A		1	1	10	0	29	9	2610.0
Remove Existing GW and Install OPGW Total	Fuel, Helicopter Support Truck	Truck1	300	Diesel	1	1	10	338	247.9	9	22275.0
Remove Existing GW and Install OPGW Total	Worker Trips	Nontruck	150	Gas	1	14	2	138	317.2	13	41236.0
Guard Structure Removal	1-Ton Truck	Truck1	300	Gas	1	2	8	288	210.0	4	1260.0
Guard Structure Removal	Compressor Trailer	AirCompressors	60	Diesel	0.48	1	4	4	1	4	4.0
Guard Structure Removal	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	1	8	0	3	4	19.0
Guard Structure Removal	Boom/Crane Truck	Cranes	350	Diesel	0.24	1	4	0	4	4	28.0
Guard Structure Removal	Worker Trips	Nontruck	150	Gas	1	3	2	138	317.2	4	1503.0
Duct Installation	1-Ton Truck	Truck1	300	Gas	1	1	8	288	210.0	2	5250.0
Duct Installation	Compressor Trailer	AirCompressors	60	Diesel	0.48	1	4	4	1	2	16.0
Duct Installation	Backhoe/Front Loader	Tractors/Loaders/Backhoes	125	Diesel	0.37	1	4	4	2	2	48.0
Duct Installation	Dump Truck	Truck2	350	Diesel	1	1	8	288	210.0	2	5250.0
Duct Installation	Water Truck	Truck1	300	Diesel	1	1	8	288	210.0	2	5250.0
Duct Installation	Worker Trips	Nontruck	150	Gas	1	6	2	138	317.2	2	7930.0
Install Underground Cable	1-Ton Truck	Truck1	300	Gas	1	2	4	188	135.0	10	1350.0
Install Underground Cable	Manlift/Bucket Truck	AerialLifts	250	Diesel	0.31	1	6	0	2	10	24.0
Install Underground Cable	Boom/Crane Truck	cranes	350	Diesel	0.24	1	4	0	3	10	32.0
Install Underground Cable	Wire Truck/Tensioner	Truck2	350	Diesel	1	2	4	288	172.8	10	1728.0
Install Underground Cable	Puller	OtherConstructionEquipment	350	Diesel	0.6	1	4	4	4	4	46.0
Install Underground Cable	Static Truck/Tensioner	Truck2	350	Diesel	1	1	4	23	172.8	10	1728.0
Install Underground Cable	Worker Trips	Nontruck	150	Gas	1	13	2	138	317.2	10	3172.0
Restoration	1-Ton Truck	Truck1	300	Gas	1	2	4	188	135.0	2	3645.0
Restoration	Backhoe/Front Loader	Tractors/Loaders/Backhoes	125	Diesel	0.37	1	4	4	11	2	26.0
Restoration	Motor Grader	graders	250	Diesel	0.41	1	4	4	3	2	87.0
Restoration	Water Truck	Truck1	300	Diesel	1	1	6	288	210.0	2	5670.0
Restoration	Drum Type Compactor	rollers	100	Diesel	0.38	1	4	4	9	2	24.0
Restoration	Lowboy Truck/Trailer	Truck2	450	Diesel	1	1	4	188	135.0	2	3645.0
Restoration	Worker Trips	Nontruck	150	Gas	1	4	2	138	317.2	2	8564.0

TOTAL - Segment 2	
Gasoline (gallons)	2,537,528
Diesel (gallons)	1,608,834
Jet A (gallons)	26,100

**Notes:**

[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/Exec/QueryPDF.cgi?Dockey=P100UXEN.pdf>.

[2] United States Department of Transportation, Bureau of Transportation Statistics. 2019. *National Transportation Statistics 2019*. Available at: <https://www.bts.gov/topics/national-transportation-statistics>.

[3] Assumed all on-road vehicles are traveling at an average speed of 65 miles per hour for two hours each day for commutes and the remaining hours of operation are at an average speed of 25 miles per hour as vehicles move around the work areas.

[4] Assumed average fuel consumption of 29 gallons per hour for similar helicopter model (<https://www.rotakhel.com/md500>).

TOTAL - Segments 1 and 2	
Gasoline (gallons)	3,504,548
Diesel (gallons)	1,915,660
Jet A (gallons)	26,100

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