

Minnesota Energy Connection Project

GHG Calculations

Table 1. Summary of Construction GHG Emissions

Regional Segment or Refinement	Association to Applicant Proposed Routes	Fuel Combustion CO ₂ e ^[1] (metric tons)	Land Use Change CO ₂ e ^[1] (metric tons)	Total CO ₂ e ^[1] (metric tons)
Regional Segment A1	applicant proposed Purple Route	2,434.25	34.58	2,468.83
Regional Segment A2	Purple variation	2,448.16	34.56	2,482.72
Regional Segment A3	applicant proposed Blue Route	2,030.86	79.31	2,110.17
Regional Segment A4	Blue variation 2	2,517.71	86.80	2,604.51
Regional Segment A5	Blue variation	2,100.41	46.74	2,147.15
Regional Segment A6	Blue variation	2,016.95	56.85	2,073.80
Regional Segment A7	Blue variation	2,030.86	54.99	2,085.85
Regional Segment B1	applicant proposed Purple Route	6,315.14	131.27	6,446.41
Regional Segment B2	Blue to purple variation 2	7,094.10	125.31	7,219.41
Regional Segment B3	Purple variation	6,523.79	122.51	6,646.30
Regional Segment B4	applicant proposed Blue Route	10,474.23	247.14	10,721.36
Regional Segment C1	applicant proposed Purple Route	7,789.60	132.34	7,921.94
Regional Segment C2	Purple to blue variation 2	8,137.35	130.87	8,268.21
Regional Segment C3	Purple to blue variation 3	8,053.89	153.81	8,207.69
Regional Segment C4	applicant proposed Blue Route	3,978.26	65.99	4,044.25
Regional Segment D1	applicant proposed Purple Route	1,265.81	30.03	1,295.84
Regional Segment D2	Purple variation	1,279.72	29.57	1,309.29
Regional Segment D3	Purple to blue variation	1,404.91	24.46	1,429.37
Regional Segment D4	applicant proposed Blue Route	1,502.28	25.39	1,527.67
Regional Segment D5	Blue variation 2	1,516.19	34.25	1,550.44
Regional Segment D6	Blue variation	1,585.74	25.24	1,610.98
Regional Segment D7	Blue variation 3	1,780.48	38.99	1,819.47
Regional Segment E1	applicant proposed Purple Route	2,462.07	73.72	2,535.79
Regional Segment E2	applicant proposed Blue Route	2,309.06	62.15	2,371.21
Regional Segment F1	applicant proposed Purple Route	306.02	12.00	318.02
Regional Segment F2	Purple to blue variation 2	319.93	13.40	333.33
Regional Segment F3	Purple to blue variation 3	375.57	6.13	381.70
Regional Segment F4	applicant proposed Blue Route	375.57	7.53	383.10
Regional Segment F5	Blue to purple variation 4	333.84	13.10	346.94
Regional Segment F6	Blue variation	375.57	6.91	382.48
Regional Segment F7	Purple variation	292.11	11.53	303.64
Regional Segment F8	Blue to purple variation 5	375.57	14.36	389.93
Regional Segment G1	applicant proposed Blue Route	3,533.14	305.32	3,838.46
Regional Segment G2	Blue variation	3,421.86	302.17	3,724.03
Regional Segment G3	applicant proposed Purple Route	3,157.57	435.80	3,593.37
Regional Segment G4	Blue to purple variation 2	3,477.50	319.72	3,797.22
Regional Segment G5	Purple variation	3,380.13	411.53	3,791.66
Regional Segment G6	Blue to purple variation 3	3,157.57	365.08	3,522.65

[1] CO₂e calculated by multiplying the GWP for each pollutant by the potential pollutant emissions. GWPs from EPA CCCL Emission Factors for Greenhouse Gas Inventories, 2024.

<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

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Table 2. Summary of Operations GHG Emissions from Fuel Combustion and Electrical Consumption

Regional Segment or Refinement	Association to Applicant Proposed Routes	Fuel Combustion CO2e ^[1] (metric tons/yr)	Electrical Consumption CO2e ^[1] (metric tons/yr)	Total CO2e ^[1] (metric tons/yr)
All	--	67.71	1,142.46	1,210.17

[1] CO2e calculated by equation A-1 of 40 CFR 98.2, which states the total CO2e is equal to the GWP for each pollutant multiplied by the potential pollutant emissions.

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Table 3. Conversions

Unit	Amount	Unit
ton	2000	lbs
ton	0.907185	metric tons
ton	907.185	kg
ton	907185	grams
lb	0.453592	kg
lb	453.592	grams
MWh	1000	kWh
hectare	2.47105	acres
1 MJ	0.372506136	hp-h
US gallon (diesel) ^[1]	144.945	MJ
US gallon (diesel)	53.9929019	hp-h
US gallon (gasoline) ^[1]	126.833	MJ
US gallon (gasoline)	47.24606261	hp-h
US gallon (jet fuel) ^[1]	142.2	MJ
US gallon (jet fuel)	52.97036342	hp-h

[1] US Energy Information Administration, 2024.

<https://www.eia.gov/energyexplained/units-and-calculators/energy-conversion-calculators.php>

[2] [https://www.convertunits.com/from/MJ/to/gallon+\[U.S.\]+of+kerosene+type+jet+fuel](https://www.convertunits.com/from/MJ/to/gallon+[U.S.]+of+kerosene+type+jet+fuel)

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Table 4. Global Warming Potentials

Greenhouse Gas Name	CAS Number	Chemical Formula	Global Warming Potential (100-yr.) [1]
Carbon dioxide	124-38-9	CO ₂	1
Methane	74-82-8	CH ₄	28
Nitrous oxide	10024-97-2	N ₂ O	265

[1] Global Warming Potentials from EPA CCCL Emission Factors for Greenhouse Gas Inventories, 2024.
<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

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Table 5. Construction Emissions from Fuel Combustion Sources

Regional Segment or Refinement	Association to Applicant Proposed Routes	Route Length ⁽¹⁾ (miles)	CO ₂ e ⁽²⁾ (metric tons)
Regional Segment A1	applicant proposed Purple Route	17.50	2,434.25
Regional Segment A2	Purple variation	17.60	2,448.16
Regional Segment A3	applicant proposed Blue Route	14.60	2,030.86
Regional Segment A4	Blue variation 2	18.10	2,517.71
Regional Segment A5	Blue variation	15.10	2,100.41
Regional Segment A6	Blue variation	14.50	2,016.95
Regional Segment A7	Blue variation	14.60	2,030.86
Regional Segment B1	applicant proposed Purple Route	45.40	6,315.14
Regional Segment B2	Blue to purple variation 2	51.00	7,094.10
Regional Segment B3	Purple variation	46.90	6,523.79
Regional Segment B4	applicant proposed Blue Route	75.30	10,474.23
Regional Segment C1	applicant proposed Purple Route	56.00	7,789.60
Regional Segment C2	Purple to blue variation 2	58.50	8,137.35
Regional Segment C3	Purple to blue variation 3	57.90	8,053.89
Regional Segment C4	applicant proposed Blue Route	28.60	3,978.26
Regional Segment D1	applicant proposed Purple Route	9.10	1,265.81
Regional Segment D2	Purple variation	9.20	1,279.72
Regional Segment D3	Purple to blue variation	10.10	1,404.91
Regional Segment D4	applicant proposed Blue Route	10.80	1,502.28
Regional Segment D5	Blue variation 2	10.90	1,516.19
Regional Segment D6	Blue variation	11.40	1,585.74
Regional Segment D7	Blue variation 3	12.80	1,780.48
Regional Segment E1	applicant proposed Purple Route	17.70	2,462.07
Regional Segment E2	applicant proposed Blue Route	16.60	2,309.06
Regional Segment F1	applicant proposed Purple Route	2.20	306.02
Regional Segment F2	Purple to blue variation 2	2.30	319.93
Regional Segment F3	Purple to blue variation 3	2.70	375.57
Regional Segment F4	applicant proposed Blue Route	2.70	375.57
Regional Segment F5	Blue to purple variation 4	2.40	333.84
Regional Segment F6	Blue variation	2.70	375.57
Regional Segment F7	Purple variation	2.10	292.11
Regional Segment F8	Blue to purple variation 5	2.70	375.57
Regional Segment G1	applicant proposed Blue Route	25.40	3,533.14
Regional Segment G2	Blue variation	24.60	3,421.86
Regional Segment G3	applicant proposed Purple Route	22.70	3,157.57
Regional Segment G4	Blue to purple variation 2	25.00	3,477.50
Regional Segment G5	Purple variation	24.30	3,380.13
Regional Segment G6	Blue to purple variation 3	22.70	3,157.57

[1] Route length obtained from GIS data analysis.

[2] CO₂ and CO₂e rate calculated for the applicants' proposed route, in tons/mile. Route length was obtained from the Route Permit Application, assuming the shortest route combination (highest rate in tons/miles) of the Green Segment and Purple Route.

Proposed Route Fuel Combustion CO ₂ e (metric tons)	Route Length (miles)	CO ₂ e Rate (metric tons/mile)
24,217.30	174.10	139.10

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Table 6. Construction Emissions from Off-Road Fuel Combustion Sources - Proposed Route Calculations

Equipment Type ^[1]	Fuel Type ^[2]	Number of Units ^[1]	Operating Time ^[1] (hours)	Estimated Loaded Horsepower ^[1]	CO ₂ Emission Factor ^[3] (kg/gal)	CH ₄ Emission Factor ^[4] (g/gal)	N ₂ O Emission Factor ^[4] (g/gal)	CO ₂ Emission Factor ^[5] (lb/hr)	CH ₄ Emission Factor ^[5] (lb/hr)	N ₂ O Emission Factor ^[5] (lb/hr)	CO ₂ (metric tons)	CH ₄ (metric tons)	N ₂ O (metric tons)	CO ₂ e ^[6] (metric tons)
Air Compressor	Diesel Equipment	5	14,700	80	10.21	1.01	0.94	33.35	0.00330	0.00307	222.38	2.20E-02	2.05E-02	228.42
ATV	Gasoline (4 stroke) - Recreational	10	12,232	10	8.78	2.72	1.48	4.10	0.00127	0.00069	22.73	7.04E-03	3.83E-03	23.94
Backhoe	Diesel Equipment	4	9,120	60	10.21	1.01	0.94	25.01	0.00247	0.00230	103.48	1.02E-02	9.53E-03	106.29
Bulldozer	Diesel Equipment	8	14,480	250	10.21	1.01	0.94	104.22	0.01031	0.00960	684.54	6.77E-02	6.30E-02	703.14
Compactor	Diesel Equipment	1	200	300	10.21	1.01	0.94	125.07	0.01237	0.01151	11.35	1.12E-03	1.04E-03	11.65
Fork Lift	Diesel Equipment	8	18,956	120	10.21	1.01	0.94	50.03	0.00495	0.00461	430.15	4.26E-02	3.96E-02	441.83
Concrete Mixer Truck	Diesel Equipment	8	23,040	325	10.21	1.01	0.94	135.49	0.01340	0.01247	1,415.97	1.40E-01	1.30E-01	1,454.44
Dump Truck	Diesel Off-Road Trucks	3	11,970	260	10.21	0.91	0.56	108.39	0.00966	0.00595	588.51	5.25E-02	3.23E-02	598.54
Excavator	Diesel Equipment	11	35,900	138	10.21	1.01	0.94	57.53	0.00569	0.00530	936.83	9.27E-02	8.63E-02	962.29
Front End Loader	Diesel Equipment	15	43,040	196	10.21	1.01	0.94	81.71	0.00808	0.00752	1,595.21	1.58E-01	1.47E-01	1,638.55
Generator	Diesel Equipment	3	14,976	125	10.21	1.01	0.94	52.11	0.00516	0.00480	353.99	3.50E-02	3.26E-02	363.61
Boom truck	Diesel Off-Road Trucks	34	58,668	50	10.21	0.91	0.56	20.84	0.00186	0.00114	554.70	4.94E-02	3.04E-02	564.15
Pickup Truck	Diesel Off-Road Trucks	58	229,276	38	10.21	0.91	0.56	15.84	0.00141	0.00087	1,647.52	1.47E-01	9.04E-02	1,675.58
Skid steer loader	Diesel Equipment	20	57,556	50	10.21	1.01	0.94	20.84	0.00206	0.00192	544.19	5.38E-02	5.01E-02	558.97
Water truck	Diesel Off-Road Trucks	5	13,904	50	10.21	0.91	0.56	20.84	0.00186	0.00114	131.46	1.17E-02	7.21E-03	133.70
Welding machine	Diesel Equipment	9	17,405	28	10.21	1.01	0.94	11.67	0.00115	0.00107	92.16	9.12E-03	8.48E-03	94.66
Grader	Diesel Equipment	1	2,880	28	10.21	1.01	0.94	11.67	0.00115	0.00107	15.25	1.51E-03	1.40E-03	15.66
Large Crane	Diesel Equipment	11	30,750	3	10.21	1.01	0.94	1.25	0.00012	0.00012	17.44	1.73E-03	1.61E-03	17.92
Medium Crane	Diesel Equipment	13	46,410	315	10.21	1.01	0.94	131.32	0.01299	0.01209	2,764.47	2.73E-01	2.55E-01	2,839.57
Fuel Truck	Diesel Off-Road Trucks	1	3,000	118	10.21	0.91	0.56	49.19	0.00438	0.00270	66.94	5.97E-03	3.67E-03	68.08
2-inch Water Pump	Diesel Equipment	6	-	3	10.21	1.01	0.94	1.25	0.00012	0.00012	-	0.00E+00	0.00E+00	-
Semitruck/Trailer	Diesel Off-Road Trucks	22	66,480	500	10.21	0.91	0.56	208.45	0.01858	0.01143	6,285.66	5.60E-01	3.45E-01	6,392.70
Light Tower	Diesel Equipment	18	40,500	50	10.21	1.01	0.94	20.84	0.00206	0.00192	382.93	3.79E-02	3.53E-02	393.33
Helicopter - Ground Idle	Jet Fuel	1	345	46	9.75	0.00	0.30	18.31	0.00000	0.00056	2.87	0.00E+00	8.82E-05	2.89
Helicopter - Hover and Climb	Jet Fuel	1	345	305	9.75	0.00	0.30	121.42	0.00000	0.00374	19.00	0.00E+00	5.85E-04	19.16
Helicopter - Approach	Jet Fuel	1	345	161	9.75	0.00	0.30	64.10	0.00000	0.00197	10.03	0.00E+00	3.09E-04	10.11
Helicopter - Flight	Jet Fuel	1	2,185	280	9.75	0.00	0.30	111.47	0.00000	0.00343	110.48	0.00E+00	3.40E-03	111.38
TOTAL	--	--	--	--	--	--	--	--	--	--	19,010.24	1.78	1.40	19,430.57

[1] Equipment and usage data obtained from Appendix J of Minnesota Energy Connection Project Route Permit Application.

[2] Fuel type assumed based on equipment type.

[3] CO₂ emissions calculated using the EPA CCCL emission factors for mobile combustion, Table 2: Mobile Combustion CO₂ 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Fuel Type	CO2 Emission Factor (kg/gal)
Diesel Fuel	10.21
Motor Gasoline	8.78
Kerosene-Type Jet Fuel	9.75

[4] CH₄ and N₂O emissions calculated using the EPA CCCL emission factors for construction/mining equipment, Table 5: Mobile Combustion CH₄ and N₂O for Non-Road Vehicles, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Vehicle Type	Fuel Type	CH4 Emission Factor (g/gal)	N2O Emission Factor (g/gal)
Aircraft	Jet Fuel	-	0.30
Construction/Mining Equipment	Diesel Equipment	1.01	0.94
Construction/Mining Equipment	Diesel Off-Road Trucks	0.91	0.56
Recreational Equipment	Gasoline (4 stroke) - Recreational	2.72	1.48

[5] Emission factors converted to lb/hr using conversion rates of 53.993 hp-hr/gal for diesel and jet fuel, and 47.246 hp-hr/gal for gasoline.

[6] CO₂e calculated by multiplying the GWP for each pollutant by the potential pollutant emissions. GWPs from EPA CCCL Emission Factors for Greenhouse Gas Inventories, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

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Table 7. Construction Emissions from On-Road Fuel Combustion Sources - Proposed Route Calculations

Vehicle Type ^[1]	Fuel Type ^[1]	Vehicles per Day ^[1]	Miles per Vehicle ^[1]	Number of Days ^[1]	Total Miles Traveled	Fuel Used ^[1] (gal)	CO ₂ Emission Factor ^[2] (kg/gal)	CH ₄ Emission Factor ^{[3][4]} (g/vehicle-mile)	N ₂ O Emission Factor ^{[3][4]} (g/vehicle-mile)	CO ₂ (metric tons)	CH ₄ (metric tons)	N ₂ O (metric tons)	CO ₂ e ^[5] (metric tons)
Commuter Vehicles	Gasoline	210	60	648	8,164,800	371,127	8.78	0.0079	0.0012	3,258.50	6.45E-02	9.80E-03	3,262.90
Delivery Trucks	Diesel	22	60	530	699,600	107,631	10.21	0.0095	0.0431	1,098.91	6.65E-03	3.02E-02	1,107.09
Concrete Mixer Trucks	Diesel	8	60	288	138,240	40,659	10.21	0.0095	0.0431	415.13	1.31E-03	5.96E-03	416.74
TOTAL	--	--	--	--	--	--	--	--	--	4,772.54	0.07	0.05	4,786.73

[1] Equipment and usage data obtained from Appendix J of Minnesota Energy Connection Project Route Permit Application.

[2] CO₂ emissions calculated using the EPA CCCL emission factors for mobile combustion, T

able 2: Mobile Combustion CO₂, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Fuel Type	CO ₂ Emission Factor (kg/gal)
Diesel Fuel	10.21
Motor Gasoline	8.78

[3] CH₄ and N₂O emissions calculated using the EPA CCCL emission factors for on-road gasoline vehicles,

Table 3: Mobile Combustion CH₄ and N₂O for On-Road Gasoline Vehicles, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Vehicle Type	Model Year	CH ₄ Emission Factor (g/gal)	N ₂ O Emission Factor (g/gal)
Gasoline Light-Duty Trucks	2021	0.0079	0.0012

[4] CH₄ and N₂O emissions calculated using the EPA CCCL emission factors for on-road diesel vehicles,

Table 4: Mobile Combustion CH₄ and N₂O for On-Road Diesel and Alternative Fuel Vehicles, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Vehicle Type	Model Year	CH ₄ Emission Factor (g/gal)	N ₂ O Emission Factor (g/gal)
Medium- and Heavy-Duty Trucks	2007-2021	0.0095	0.0431

[5] CO₂e calculated by multiplying the GWP for each pollutant by the potential pollutant emissions. GWPs from EPA CCCL Emission Factors for Greenhouse Gas Inventories, 2024.

<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

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Table 8. Land Use Change Emission Factor Calculations

Temporary Land Use Change	2022 Net CO ₂ Flux for Converted Land Type ^[1] (M metric tons CO ₂ e)	2022 Total US Land Use Change from Forest Land ^[2] (thousands of hectares)	CO ₂ e Emission Factor (metric tons CO ₂ e/acre)
Forest Land to Grassland	46.8	3,894	4.86
Cropland to Grassland	(12.5)	11,444	(0.44)
Settlement to Grassland	(0.8)	93	(3.48)
Forest Land to Settlement	58.6	440	53.90
Cropland to Settlement	2.9	1,228	0.96
Grassland to Settlement	7.5	1,648	1.84

[1] Net CO₂ flux tables for converted land types. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2022.

<https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2022>

[2] Table 6-5: Land Use and Land-Use Change for the U.S. Managed Land Base for All 50 States, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 2022.

<https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2022>

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Table 9. Construction Emissions from Land Use Change

Regional Segment or Refinement	Association to Applicant Proposed Routes	Temporary Land Use Change from Forest Land to Settlement ^[1] (acres)	Temporary Land Use Change from Cropland to Settlement ^[1] (acres)	Temporary Land Use Change from Grassland to Settlement ^[1] (acres)	CO ₂ e ^{[2][3]} (metric tons)
Regional Segment A1	applicant proposed Purple Route	-	197.00	12.00	34.58
Regional Segment A2	Purple variation	-	193.00	14.00	34.56
Regional Segment A3	applicant proposed Blue Route	5.00	219.00	2.00	79.31
Regional Segment A4	Blue variation 2	5.00	259.00	6.00	86.80
Regional Segment A5	Blue variation	1.00	218.00	12.00	46.74
Regional Segment A6	Blue variation	3.00	185.00	4.00	56.85
Regional Segment A7	Blue variation	3.00	177.00	2.00	54.99
Regional Segment B1	applicant proposed Purple Route	2.00	665.00	30.00	131.27
Regional Segment B2	Blue to purple variation 2	1.00	695.00	24.00	125.31
Regional Segment B3	Purple variation	2.00	615.00	27.00	122.51
Regional Segment B4	applicant proposed Blue Route	7.00	1,082.00	50.00	247.14
Regional Segment C1	applicant proposed Purple Route	-	827.00	8.00	132.34
Regional Segment C2	Purple to blue variation 2	1.00	740.00	19.00	130.87
Regional Segment C3	Purple to blue variation 3	1.00	913.00	5.00	153.81
Regional Segment C4	applicant proposed Blue Route	1.00	354.00	5.00	65.99
Regional Segment D1	applicant proposed Purple Route	1.00	129.00	3.00	30.03
Regional Segment D2	Purple variation	1.00	128.00	2.00	29.57
Regional Segment D3	Purple to blue variation	-	148.00	4.00	24.46
Regional Segment D4	applicant proposed Blue Route	-	152.00	5.00	25.39
Regional Segment D5	Blue variation 2	1.00	152.00	5.00	34.25
Regional Segment D6	Blue variation	-	151.00	5.00	25.24
Regional Segment D7	Blue variation 3	1.00	186.00	3.00	38.99
Regional Segment E1	applicant proposed Purple Route	3.00	275.00	13.00	73.72
Regional Segment E2	applicant proposed Blue Route	3.00	211.00	8.00	62.15
Regional Segment F1	applicant proposed Purple Route	1.00	20.00	-	12.00
Regional Segment F2	Purple to blue variation 2	1.00	27.00	1.00	13.40
Regional Segment F3	Purple to blue variation 3	-	39.00	-	6.13
Regional Segment F4	applicant proposed Blue Route	-	46.00	1.00	7.53
Regional Segment F5	Blue to purple variation 4	1.00	27.00	-	13.10
Regional Segment F6	Blue variation	-	44.00	-	6.91
Regional Segment F7	Purple variation	1.00	17.00	-	11.53
Regional Segment F8	Blue to purple variation 5	1.00	35.00	-	14.36
Regional Segment G1	applicant proposed Blue Route	29.00	281.00	14.00	305.32
Regional Segment G2	Blue variation	29.00	261.00	14.00	302.17
Regional Segment G3	applicant proposed Purple Route	44.00	256.00	19.00	435.80
Regional Segment G4	Blue to purple variation 2	30.00	297.00	24.00	319.72
Regional Segment G5	Purple variation	41.00	263.00	23.00	411.53
Regional Segment G6	Blue to purple variation 3	36.00	257.00	19.00	365.08

[1] Land use areas obtained from the National Land Cover Database for the ROW (75 feet).

[2] See land use change emission factors calculation table.

[3] Emissions are calculated for an assumed 60-day duration of temporary disturbance.

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Table 10. Operation Emissions from Fuel Combustion Sources

Activity ^[1]	Activity Frequency ^[1]	Vehicle Type ^[1]	Fuel Type ^[1]	Number of Units ^[1]	Fuel Usage per Activity ^[1] (gal)	Number of Activity in 12 Years ^[1]	Annual Fuel Usage ^[1] (gal)	CO ₂ Emission Factor ^[2] (kg/gal)	CH ₄ Emission Factor ^[3] (g/gal)	N ₂ O Emission Factor ^[3] (g/gal)	CO ₂ (metric tons/yr)	CH ₄ (metric tons/yr)	N ₂ O (metric tons/yr)	CO ₂ e ^[4] (metric tons/yr)
Transmission Line Ground Inspections	Every 4 years	Pickup Truck	Diesel	2	26	3	6.5	10.21	0.91	0.56	0.07	5.92E-06	3.64E-06	0.07
Transmission Line Ground Inspections	Every 4 years	ATV	Gasoline	2	50	3	12.5	8.78	2.72	1.48	0.11	3.40E-05	1.85E-05	0.12
Transmission Line Drone Inspections	Every 4 years, alternating	Pickup Truck	Diesel	1	13	3	3.25	10.21	0.91	0.56	0.03	2.96E-06	1.82E-06	0.03
Transmission Line Aerial Inspections	Annually	Helicopter	Jet A Fuel	1	460.2	12	460.2	9.75	0.00	0.30	4.49	0.00E+00	1.38E-04	4.52
Substation Inspections	Quarterly	Pickup Truck	Diesel	6	40	48	160	10.21	0.91	0.56	1.63	1.46E-04	8.96E-05	1.66
Substation Inspections - Relay Testing	Every 6 years	Chevy Suburban	Gasoline	6	2025	2	337.5	8.78	2.85	1.47	2.96	9.62E-04	4.96E-04	3.12
Vegetation Maintenance - Line Inspection / QC	Every 4 years	Pickup Truck	Gasoline	1	289	3	72.25	8.78	2.85	1.47	0.63	2.06E-04	1.06E-04	0.67
Vegetation Maintenance - Line Inspection / QC	Every 4 years	ATV	Gasoline	1	417	3	104.25	8.78	2.72	1.48	0.92	2.84E-04	1.54E-04	0.96
Vegetation Maintenance - Contractor Foreman	Every 4 years	Pickup Truck	Gasoline	2	2800	3	700	8.78	2.85	1.47	6.15	2.00E-03	1.03E-03	6.47
Vegetation Maintenance - Contractor Foreman	Every 4 years	ATV	Gasoline	2	4167	3	1041.75	8.78	2.72	1.48	9.15	2.83E-03	1.54E-03	9.63
Vegetation Maintenance - Contractor Spray Crew	Every 4 years	Pickup Truck	Gasoline	1	289	3	72.25	8.78	2.85	1.47	0.63	2.06E-04	1.06E-04	0.67
Vegetation Maintenance - Contractor Spray Crew	Every 4 years	ATV	Gasoline	1	417	3	104.25	8.78	2.72	1.48	0.92	2.84E-04	1.54E-04	0.96
Vegetation Maintenance - Contractor Vegetation Crew	Every 4 years	Bucket Truck	Diesel	3	12120	3	3030	10.21	1.01	0.94	30.94	3.06E-03	2.85E-03	31.78
Vegetation Maintenance - Contractor Special Crew	Every 4 years	Mechanical Saw	Diesel	2	1080	3	270	10.21	1.01	0.94	2.76	2.73E-04	2.54E-04	2.83
Vegetation Maintenance - Contractor Lidar Patrol	Every 4 years	Helicopter	Jet A Fuel	1	1709	3	427.25	9.75	0.00	0.30	4.17	0.00E+00	1.28E-04	4.20
TOTAL	--	--	--	--	--	--	--	--	--	--	65.54	0.01	7.07E-03	67.71

[1] Fuel data provided electronically by Xcel Energy via Supplemental Information Inquiry #1 on 05/10/2024.

[2] CO₂ emissions calculated using the EPA CCCL emission factors for mobile combustion, Table 2: Mobile Combustion CO₂, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

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Table 10. Operation Emissions from Fuel Combustion Sources

Fuel Type	CO2 Emission Factor (kg/gal)
Diesel Fuel	10.21
Motor Gasoline	8.78
Kerosene-Type Jet Fuel	9.75

[3] CH₄ and N₂O emissions calculated using the EPA CCCL emission factors for construction/mining equipment, Table 5: Mobile Combustion CH₄ and N₂O for Non-Road Vehicles, 2024.
<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

Vehicle Type	Fuel Type	CH4 Emission Factor (g/gal)	N2O Emission Factor (g/gal)
Aircraft	Jet Fuel	-	0.30
Construction/Mining Equipment	Gasoline (4 stroke)	2.85	1.47
Construction/Mining Equipment	Diesel Equipment	1.01	0.94
Construction/Mining Equipment	Diesel Off-Road Trucks	0.91	0.56
Recreational Equipment	Gasoline (4 stroke) - Recreational	2.72	1.48

[4] CO₂e calculated by multiplying the GWP for each pollutant by the potential pollutant emissions. GWPs from EPA CCCL Emission Factors for Greenhouse Gas Inventories, 2024.
<https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>

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Table 11. Operation Emissions from Land Use Change

Regional Segment or Refinement	Association to Applicant Proposed Routes	Temporary Land Use Change from Forest Land to Grassland ^[1] (acres)	Temporary Land Use Change from Cropland to Grassland ^[1] (acres)	Temporary Land Use Change from Settlement to Grassland ^[1] (acres)	CO ₂ e ^{[2][3]} (metric tons/yr)
Regional Segment A1	applicant proposed Purple Route	-	197	110	(470.01)
Regional Segment A2	Purple variation	-	193	113	(478.68)
Regional Segment A3	applicant proposed Blue Route	5	219	39	(208.25)
Regional Segment A4	Blue variation 2	5	259	60	(299.04)
Regional Segment A5	Blue variation	1	218	43	(241.19)
Regional Segment A6	Blue variation	3	185	73	(321.31)
Regional Segment A7	Blue variation	3	177	83	(352.59)
Regional Segment B1	applicant proposed Purple Route	2	665	127	(726.33)
Regional Segment B2	Blue to purple variation 2	1	695	203	(1,009.02)
Regional Segment B3	Purple variation	2	615	208	(986.20)
Regional Segment B4	applicant proposed Blue Route	7	1,082	225	(1,227.49)
Regional Segment C1	applicant proposed Purple Route	-	827	183	(1,002.61)
Regional Segment C2	Purple to blue variation 2	1	740	304	(1,380.51)
Regional Segment C3	Purple to blue variation 3	1	913	133	(861.70)
Regional Segment C4	applicant proposed Blue Route	1	354	161	(712.08)
Regional Segment D1	applicant proposed Purple Route	1	129	30	(156.59)
Regional Segment D2	Purple variation	1	128	38	(184.00)
Regional Segment D3	Purple to blue variation	-	148	29	(166.37)
Regional Segment D4	applicant proposed Blue Route	-	152	39	(202.95)
Regional Segment D5	Blue variation 2	1	152	40	(201.57)
Regional Segment D6	Blue variation	-	151	51	(244.29)

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Table 11. Operation Emissions from Land Use Change

Regional Segment or Refinement	Association to Applicant Proposed Routes	Temporary Land Use Change from Forest Land to Grassland ^[1] (acres)	Temporary Land Use Change from Cropland to Grassland ^[1] (acres)	Temporary Land Use Change from Settlement to Grassland ^[1] (acres)	CO ₂ e ^{[2][3]} (metric tons/yr)
Regional Segment D7	Blue variation 3	1	186	42	(223.56)
Regional Segment E1	applicant proposed Purple Route	3	275	31	(214.88)
Regional Segment E2	applicant proposed Blue Route	3	211	79	(353.69)
Regional Segment F1	applicant proposed Purple Route	1	20	17	(63.16)
Regional Segment F2	Purple to blue variation 2	1	27	12	(48.85)
Regional Segment F3	Purple to blue variation 3	-	39	8	(45.09)
Regional Segment F4	applicant proposed Blue Route	-	46	1	(23.81)
Regional Segment F5	Blue to purple variation 4	1	27	17	(66.25)
Regional Segment F6	Blue variation	-	44	2	(26.41)
Regional Segment F7	Purple variation	1	17	21	(75.76)
Regional Segment F8	Blue to purple variation 5	1	35	14	(59.34)
Regional Segment G1	applicant proposed Blue Route	29	281	135	(453.12)
Regional Segment G2	Blue variation	29	261	140	(461.69)
Regional Segment G3	applicant proposed Purple Route	44	256	90	(212.46)
Regional Segment G4	Blue to purple variation 2	30	297	101	(336.97)
Regional Segment G5	Purple variation	41	263	111	(303.25)
Regional Segment G6	Blue to purple variation 3	36	257	98	(279.66)

[1] Land use areas obtained from the National Land Cover Database for the ROW (75 feet).

[2] See land use change emission factors calculation table.

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Table 12. Operation Emissions from Electrical Consumption

Source	Energy Consumption ^[1] (kWh/year)	eGRID Subregion	CO ₂ Emission Factor ^[2] (lb/MWh)	CH ₄ Emission Factor ^[2] (lb/MWh)	N ₂ O Emission Factor ^[2] (lb/MWh)	CO ₂ (metric tons/year)	CH ₄ (metric tons/year)	N ₂ O (metric tons/year)	CO ₂ e ^[3] (metric tons/year)
Garvin Substation	1,060,000	MROW	936.5	0.102	0.015	450.28	0.05	0.01	453.56
Intermediate Substation	700,000	MROW	936.5	0.102	0.015	297.35	0.03	0.00	299.52
Voltage Support Substation	910,000	MROW	936.5	0.102	0.015	386.56	0.04	0.01	389.38
TOTAL	2,670,000	--	--	--	--	1,134.19	0.12	0.02	1,142.46

[1] Electrical consumption provided electronically by Xcel Energy via Supplemental Information Inquiry #1 on 05/10/2024.

[2] Table 6, Electricity. Emission Factors for Greenhouse Gas Inventories, EPA CCCL. February, 2024. <https://www.epa.gov/climateleadership/ghg-emission-factors-hub>

[3] CO₂e calculated by multiplying the GWP for each pollutant by the potential pollutant emissions. GWPs from EPA CCCL Emission Factors for Greenhouse Gas Inventories, 2024. <https://www.epa.gov/system/files/documents/2024-02/ghg-emission-factors-hub-2024.pdf>