Appendix B2

Supporting Mass Emission Calculations

Table 0.1 - Feedstock and Fuel Throughputs

Material	Quantity of Equipment	Hourly Throughput Wet	Annual Throughput Wet		Annual Throughput Dry	Moisture Content	Comments
		MTPH	MTPY	STPY	STPY	%	
Roundwood Received	-	73.5	590,940	651,400	390,840	40	Based on HMB (50/50 split).
Green Residuals Received	-	73.5	590,940	651,400	411,685	37	Based on HMB (50/50 split).
Max Green Hammer Mill Throughput	3	36.0	946,080	1,042,874	668,482	36	Based on max equipment throughput @ max potential operating hours. Should be verified with vendor (Bruks: Proposal No. 22-011095-HM, 5/13/22).
Max Dry Hammer Mill Throughput	7	14.0	858,480	946,312	851,681	10	Based on max equipment throughput @ max potential operating hours. Should be verified with vendor (Prodesa: Offer No. 2934-OFS-05-0002A, 5/11/22).
Max Pellet Mill Throughput	18	5.05	796,284	877,753	798,755	9	Based on max equipment throughput @ max potential operating hours. Should be verified with vendor (Prodesa: Offer No. 2934-OFS-05-0002A, 5/11/22).
Finished Pellets Throughput	-	87.1	700,000	771,618	717,604	7	Based on capacity rating of facility.
Fuel Screen Throughput	-	13.3	106,932	117,872	74,377	37	Based on HMB (50/50 split). Bark from debarking drum + purchased fuel + woodyard green screen overs.

Table 0.2 - Particulate Collection Operating Parameters

Equipment	Quantity of Equipment	Air Flow Each	Air Flow Total	Inlet Loading	Assumed Outlet Loading	Comments
		dscfm	dscfm	gr/dscf	gr/dscf	
Green Hammer Mill Air System	3	0	0		0.01	GHMs (Bruks) utilize recirculation instead of collection.
Dry Hammer Mill Cyclone	4	25,000	100,000		0.02	Based on vendor proposal (Prodesa: Offer No. 2934-OFS-05-0002A,
Pellet Cooler Baghouses	2	50,000	100,000		0.002	Approximation based on email from vendor (Prodesa, Mike Curci,
Pellet Storage - Vent Fan	3	2,702	8,105		0.01	Approximation based on email from vendor (Prodesa, Forcus Martinez,
Pellet Storage - High Temp Fans	9	0	0		0.01	Approximation based on email from vendor (Prodesa, Forcus Martinez,
Railcar Loadout Baghouse	1	50,000	50,000		0.002	Air flow from Nexus - 9/1/23 email (Prodesa). Updated per Nexus email

Table 0.3 - Combustion Units Emission Guarantees

Equipment	Quantity of Equipment	Pollutant	Emissions Guarantee Each		Emissions Guarantee Total		Comments
			lb/hr	STPY	lb/hr	STPY	
Dryer/RTO	2	CO	25.0	109.5	50.0	219.0	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22).
Dryer/RTO	2	NOx	29.5	118.3	59.0	236.5	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated annual - 9/8/23 email from Nexus - TSI update.
Dryer/RTO	2	PM	5.2	24.1	10.4	48.2	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated annual - 9/8/23 email from Nexus - TSI update.
Dryer/RTO	2	SO2		0.0	0.0	0.0	
Dryer/RTO	2	VOC	11.3	28.5	22.6	56.9	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated annual - 9/8/23 email from Nexus - TSI update.
Dryer/RTO	2	Total HAP		0.0	0.0	0.0	
Dryer/RTO	2	CO2	50,000.0	219,000.0	100,000.0	438,000.0	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).
Dryer/RTO	2	CH4	1.8	7.7	3.5	15.3	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).
RCO	1	VOC	14.0	77.8	14.0	77.8	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated per Nexus email 9/15/23
RCO	1	CO2	3,000.0	13,140.0	3,000.0	13,140.0	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).
RCO	1	CH4	7.5	32.9	7.5	32.9	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).

Table 0.4 - Combustion Units Burner Parameters

Equipment	Quantity of Equipment	Heat Input Each	Heat Input Total	Comments
		MMBtu/hr	MMBtu/hr	
Tar Buildup Control Burner	0	0.0	0.0	Eliminated based on email from vendor (TSI, Zo Savovic, 8/9/22).
RTO Burner System	2	5.1	10.2	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
RTO - Bakeout Operation	2	20.0	40.0	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
RCO Burner System	1	8.3	8.3	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
RCO - Bakeout Operation	1	25.0	25.0	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
Furnaces (Dryer Heat)	2	80.3	160.6	CEQA Data Request provided to Trinity

Table 0.5 - Diesel Fire Pump Operating Parameters

Maximum Power Output	
kW	HP
112	150

Table 1.1 - Facility-Wide Emissions

Emission Source	CO	NOx	Filterable PM	Total PM10	Total PM2.5	SO2	VOC	CO2e	Acetaldehyde	Formaldehyde	Methanol	Total HAP
	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY
Roundwood Processing												
Truck Unloading	-	-	1.70E-02	8.05E-03	1.22E-03	-	-	-	-	-	-	-
Log Pile	-	-	1.70E-02	8.05E-03	1.22E-03	-	-	-	-	-	-	-
Drum Debarker	-	-	1.70E-02	8.05E-03	1.22E-03	-	-	-	-	-	-	-
Chipper	-	-	1.70E-02	8.05E-03	1.22E-03	-	-	-	-	-	-	-
Green Residuals Processing												
Truck Unloading	-	-	1.91E-02	9.05E-03	1.37E-03	-	-	-	-	-	-	-
Woodyard Chip Screening	-	-	3.83E-02	1.81E-02	2.74E-03	-	-	-	-	-	-	-
Woodyard Fuel Screening	-	-	3.46E-03	1.64E-03	2.48E-04	-	-	-	-	-	-	-
Wood Chip Piles	-	-	3.48E-02	1.65E-02	2.49E-03	-	-	-	-	-	-	-
Green Hammer Mill Screening	-	-	3.48E-02	1.65E-02	2.49E-03	-	-	-	-	-	-	-
Green Hammer Mills	-	-	0	0	0	-	0	-	0	0	0	0
Drying												
Dryer	219.0	118.3	48.2	53.4	53.4	-	56.9	-	2.60	3.31	2.60	12.7
RTO Burners	3.40	5.89	0.09	0.32	0.32	-		5,791	-	1.22E-03	-	3.08E-02
Furnace Abort Operation	4.63	1.70	4.32	3.85	3.31	0.19	0.13	1,537	6.40E-03	3.39E-02	-	2.99E-01
Dry Chips Storage												
Dry Chips Storage	-	-	0.17	0.08	1.23E-02	-	56.8	-	0.47	0.95	0.92	2.34
Pelletizing												
Dry Hammer Mills	-	-	68.9	68.9	68.9	-	59.1	-	0.09	0.19	0.09	0.48
Pellet Mills and Pellet Coolers	-	-	6.9	6.9	6.9	-	11.0	-	2.19E-02	4.39E-02	2.19E-02	0.21
Pellet Storage & Loadout												
Pellet Storage & Loadout	-	-	6.24	6.24	6.24	-	7.7	-	0.02	0.04	0.02	0.08
Balance of Plant												
RCO Burners	2.76	4.78	7.36E-02	0.26	0.26	5.52E-03	3.68E-01	4,700	-	9.93E-04	-	2.50E-02
Diesel Fire Pump	0.10	0.47	0.03	0.03	0.03	0.03	0.04	17.3	8.05E-05	1.24E-04	-	6.78E-04
Facility-Wide Total With Fugitives	229.9	131.1	135.1	140.1	139.4	0.23	192.0	12,045	3.22	4.57	3.66	16.2
Facility-Wide Total Without Fugitives	229.9	131.1	134.9	140.0	139.4	0.23	192.0	12,045	3.22	4.57	3.66	16.2
Title V Major Source Threshold	100	100	100	100	100	100	100	-	10	10	10	25
Above Title V Threshold?	Yes	Yes	Yes	Yes	Yes	No	Yes	-	No	No	No	No
PSD Major Source Threshold	250	250	250	250	250	250	250	75,000	-	-	-	-
Above PSD Threshold?[1]	No	No	No	No	No	No	No	No	-	-	-	-

CO	NOx	Filterable PM	Total PM10	Total PM2.5	SO2	VOC
lb/hr						
		0.003886	0.001838	0.000278		
		0.003886	0.001838	0.000278		
		0.003886	0.001838	0.000278		
		0.003886	0.001838	0.000278		
		0	0	0		
		0.004367	0.002066	0.000313		
		0.008735	0.004131	0.000626		
		0.00079	0.000374	5.66E-05		
		0.007944	0.003757	0.000569		
		0.007944	0.003757	0.000569		
		0	0	0		
50	26.99772	11.00457	12.19286	12.19286	#VALUE!	12.99087
0.776331	1.34564	0.020702	0.072458	0.072458	#VALUE!	0
1.056	0.3872	0.9856	0.88	0.7568	0.044	0.02992
0	0	0	0	0	0	0
#VALUE!	#VALUE!	0.039318	0.018596	0.002816	#VALUE!	12.96318
0	0	0	0	0	0	0
#VALUE!	#VALUE!	15.73386	15.73386	15.73386	#VALUE!	13.50331
#VALUE!	#VALUE!	1.573386	1.573386	1.573386	#VALUE!	2.505002
0	0	0	0	0	0	0
#VALUE!	#VALUE!	1.424285	1.424285	1.424285	#VALUE!	1.761684
0	0	0	0	0	0	0
0.630025	1.092043	0.016801	0.058802	0.058802	0.00126	0.084003
0.022877	0.106164	0.007534	0.007534	0.007534	0.007021	0.008459

Notes:

1. A wood pellet production facility is not considered within a stationary source category as listed in 40 CFR Part 70 State Operating Permit Programs. Therefore, fugitives are excluded from PSD Major Source determination.

Table 2.1 - Roundwood Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Truck Unloading	651,400
Log Pile	651,400
Drum Debarker	651,400
Chipper	651,400

Notes:
1. Annual throughput based on amount of roundwood required per finished pellet production design.

Table 2.2 - Raw Material Handling Emission Factors

Pollutant	Emission Factor[1]
	lb/ton
Filterable PM	5.23E-05
Filterable PM_{10}	2.47E-05
Filterable $PM_{2.5}$	3.74E-06

Notes:
1. PM emisson factors for receiving and storage calculated using continuous drop point equation from AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (11/06).

$$E = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:
E = emission factor (lb/ton)
k = particle size mulitiplier (dimensionless)

k (PM)	0.74
k (PM_{15})	0.48
k (PM_{10})	0.35
k (PM_{5})	0.20
k ($PM_{2.5}$)	0.053
U = mean wind speed (mph)	6.7
M = material moisture content (%)	40

Table 2.3 - Potential Emissions from Raw Material Handling

Emission Source	Filterable PM	Filterable PM_{10}	Filterable $PM_{2.5}$
	STPY	STPY	STPY
Truck Unloading	1.70E-02	8.05E-03	1.22E-03
Log Pile	1.70E-02	8.05E-03	1.22E-03
Drum Debarker	1.70E-02	8.05E-03	1.22E-03
Chipper	1.70E-02	8.05E-03	1.22E-03

Table 3.1 - Green Residuals Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Truck Unloading	651,400
Woodyard Chip Screening	1,302,799
Woodyard Fuel Screening	117,872
Wood Chip Piles	1,184,927
Green Hammermill Screening	1,184,927

Notes:
1. Annual throughput based on amount of green residuals required per finished pellet production design.

Table 3.2 - Raw Material Handling Emission Factors

Pollutant	Emission Factor[1]
	lb/ton
Filterable PM	5.87E-05
Filterable PM_{10}	2.78E-05
Filterable $PM_{2.5}$	4.21E-06

Notes:
1. PM emisson factors for receiving and storage calculated using continuous drop point equation from AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (11/06).

$$E = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:
E = emission factor (lb/ton)
k = particle size mulitiplier (dimensionless)

k (PM)	0.74
k (PM_{15})	0.48
k (PM_{10})	0.35
k (PM_{5})	0.20
k ($PM_{2.5}$)	0.053

U = mean wind speed (mph) 6.7
M = material moisture content (%) 37

Table 3.3 - Potential Emissions from Raw Material Handling

Emission Source	Filterable PM	Filterable PM_{10}	Filterable $PM_{2.5}$
	STPY	STPY	STPY
Truck Unloading	1.91E-02	9.05E-03	1.37E-03
Woodyard Chip Screening	3.83E-02	1.81E-02	2.74E-03
Woodyard Fuel Screening	3.46E-03	1.64E-03	2.48E-04
Wood Chip Piles	3.48E-02	1.65E-02	2.49E-03
Green Hammermill Screening	3.48E-02	1.65E-02	2.49E-03

Table 4.1 - Green Hammermill Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Green Hammer Mills	1,042,874

Notes:
1. Annual throughput of green residuals processed through the green hammermill, based on max capacity of green hammermill.

Table 4.2 - Green Hammermill Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Green Hammer Mill Air Sys	0	1.00E-02	0	0

Table 4.3 - Green Hammermill Potential VOC and HAP Emissions

Pollutant	Emission Factor	Control Efficiency[4]	Potential Emissions[4]
	lb/ton	%	STPY
VOC*	1.08	100	0
Acetaldehyde[1]	4.00E-03	100	0
Formaldehyde[1]	8.00E-03	100	0
Methanol[1]	4.00E-03	100	0
Acrolein[2]	0	100	0
Phenol[3]	4.50E-03	100	0
Propionaldehyde[2]	0	100	0
Total HAP	-	-	0

Notes:
1. Emission factor per GAEPD recommendation for hammermill at wood pellet manufacturing facility.
2. Emission factor below detectable limit per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
3. Emission factor from AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
4. Emissions are recirculated into the process stream and are not removed from the process. Therefore, no emissions are emitted.

Table 5.1 - Dryer Operating Parameters

Annual Throughput Wet[1]	Potential Operation
ODT/yr	hr/yr
946,312	8,040

Notes:
1. Annual throughput based on maxium dry hammermill throughput. ODT (oven dried ton) is considered to equate to 10% moisture content.

Table 5.2 - Dryer Potential Emissions

Pollutant	Wood Drying Emission Factor[3]	WESP Control Efficiency[4]	RTO Control Efficiency[5]	Potential Emissions[6]
	lb/ODT	%	%	STPY
CO[1]	5.3	0	50	219.0
NOx[1]	2.7	0	50	118.3
Filterable PM[1]	2.2	99	0	48.2
Condensable PM	1.1	99	0	5.2
Total PM_{10}[2]	3.3	99	0	53.4
Total $PM_{2.5}$[2]	3.3	99	0	53.4
VOC[1]	6	0	95	56.9
HAP				
Acetaldehyde	0.11	0	95	2.6
Formaldehyde	0.14	0	95	3.3
Methanol	0.11	0	95	2.6
Acrolein	0.023	0	95	0.5
HCl	0.019	70	0	2.7
Phenol	0.028	0	95	0.7
Propionaldehyde	0.013	0	95	0.3
Total HAP	-	-	-	12.7

Notes:
1. Potential emissions per vendor documentation for the Dryer/RTO system and SNCR (50% controls for NOx).
2. Emission factor is the sum of the filterable PM and condensable PM. For conservatism, it is assumed filterable PM_{10} = filterable $PM_{2.5}$.
3. Emission factor per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility and AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-3 at particleboard manufacturing facility. Filterable PM is conservative as GAEPD considers 2.2 lb/ODT to be total PM while AP-42 Section
4. WESP PM control effiiciency per EPA-452/F-03-029 Air Pollution Control Technology Fact Sheet. WESP HCl control efficiency per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet
5. RTO control effiiciency per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility.
6. Potential emissions are based on vendor data where available and calculated where not available.

Table 5.3 - Furnace Abort Operation Parameters

Furnaces Heat Input	Potential Operation[1]
MMBtu/hr	hr/yr
160.6	96

Notes:
1. Presumed abort stack use (and combustion emissions not controlled by RTO) for up to 8 hr/month.

Table 5.4 - Furnace Abort Operation Potential Emissions

Pollutant	Wood Combustion Emission Factor[3]	Potential Emissions[6]
	lb/MMBtu	STPY
CO[2]	0.60	4.63
NOx[2]	0.22	1.70
Filterable PM[1]	0.56	4.32
Filterable PM_{10}[1]	0.50	3.85
Filterable $PM_{2.5}$[1]	0.43	3.31
VOC[3]	0.017	0.13
SO2[2]	0.025	0.19
CO2	195	1,503
N2O	0.013	0.10
CH4	0.021	0.16
CO2e[5]	199.4	1,537
HAP[3,4]		
1,1,1-Trichloroethane	5.50E-05	4.24E-04
1,2-Dibromoethene	3.10E-05	2.39E-04
2-Chloronaphthalene	2.40E-09	1.85E-08
Acenaphthene	9.10E-07	7.02E-06
Acenaphthylene	5.00E-06	3.85E-05
Acetaldehyde	8.30E-04	6.40E-03
Acrolein	4.00E-03	3.08E-02
Anthracene	3.00E-06	2.31E-05
Antimony	7.90E-06	6.09E-05
Arsenic	2.20E-05	1.70E-04
Benzene	4.20E-03	3.24E-02
Benzo(a)anthracene	6.50E-08	5.01E-07
Benzo(a)pyrene	2.60E-06	2.00E-05
Benzo(b)fluoranthene	1.00E-07	7.71E-07
Benzo(e)pyrene	2.60E-09	2.00E-08

Benzo(g,h,i)perylene	9.30E-08	7.17E-07
Benzo(j,k)fluoranthene	1.60E-07	1.23E-06
Benzo(k)fluoranthene	3.60E-08	2.78E-07
Beryllium	1.10E-06	8.48E-06
Bis(2-ethylhexyl)phthalate	4.70E-08	3.62E-07
Bromomethane	1.50E-05	1.16E-04
Cadmium	4.10E-06	3.16E-05
Carbazole	1.80E-06	1.39E-05
Carbon tetrachloride	4.50E-05	3.47E-04
Chlorine	7.90E-04	6.09E-03
Chlorobenzene	3.30E-05	2.54E-04
Chloroform	2.80E-05	2.16E-04
Chromium	2.10E-05	1.62E-04
Chromium VI	3.50E-06	2.70E-05
Chrysene	3.80E-08	2.93E-07
Cobalt	6.50E-06	5.01E-05
Decachlorobiphenyl	2.70E-10	2.08E-09
Dibenzo(a,h)anthracene	9.10E-09	7.02E-08
Dichlorobiphenyl	7.40E-10	5.70E-09
1,2-Dichloroethane	2.90E-05	2.24E-04
1,2-Dichloropropane	3.30E-05	2.54E-04
2,4-Dinitrophenol	1.80E-07	1.39E-06
Ethylbenzene	3.10E-05	2.39E-04
Fluoranthene	1.60E-06	1.23E-05
Fluorene	3.40E-06	2.62E-05
Formaldehyde	4.40E-03	3.39E-02
Hydrogen Chloride	1.90E-02	1.46E-01
Heptachlorobiphenyl	6.60E-11	5.09E-10
Hexachlorobiphenyl	5.50E-10	4.24E-09
Heptachlorodibenzo-p-dioxins	2.00E-09	1.54E-08
Heptachlorodibenzo-p-furans	2.40E-10	1.85E-09
Hexachlorodibenzo-p-dioxins	1.60E-06	1.23E-05
Hexachlorodibenzo-p-furans	2.80E-10	2.16E-09
Indeno(1,2,3,c,d)pyrene	8.70E-08	6.71E-07
Lead	4.80E-05	3.70E-04
Manganese	1.60E-03	1.23E-02
Mercury	3.50E-06	2.70E-05
Methyl chloride (chloromethane)	2.30E-05	1.77E-04
2-Methylnaphthalene	1.60E-07	1.23E-06
Methylene chloride (dichloromethane)	2.90E-04	2.24E-03
Monochlorobiphenyl	2.20E-10	1.70E-09
Naphthalene	9.70E-05	7.48E-04
Nickel	3.30E-05	2.54E-04
4-Nitrophenol	1.10E-07	8.48E-07
Octachlorodibenzo-p-dioxins	6.60E-08	5.09E-07
Octachlorodibenzo-p-furans	8.80E-11	6.78E-10
Pentachlorodibenzo-p-dioxins	1.50E-09	1.16E-08
Pentachlorodibenzo-p-furans	4.20E-10	3.24E-09
Pentachlorobiphenyl	1.20E-09	9.25E-09

Pentachlorophenol	5.10E-08	3.93E-07
Perylene	5.20E-10	4.01E-09
Phenanthrene	7.00E-06	5.40E-05
Phenol	5.10E-05	3.93E-04
Phosphorus	2.70E-05	2.08E-04
Propionaldehyde	6.10E-05	4.70E-04
Pyrene	3.70E-06	2.85E-05
Selenium	2.80E-06	2.16E-05
Styrene	1.90E-03	1.46E-02
2,3,7,8-Tetrachlorodibenzo-p-dioxins	8.60E-12	6.63E-11
Tetrachlorodibenzo-p-dioxins	4.70E-10	3.62E-09
2,3,7,8-Tetrachlorodibenzo-p-furans	9.00E-11	6.94E-10
Tetrachlorodibenzo-p-furans	7.50E-10	5.78E-09
Tetrachlorobiphenyl	2.50E-09	1.93E-08
Tetrachloroethene	3.80E-05	2.93E-04
Toluene	9.20E-04	7.09E-03
Trichlorobiphenyl	2.60E-09	2.00E-08
Trichloroethylene (trichloroethene)	3.00E-05	2.31E-04
2,4,6-Trichlorophenol	2.20E-08	1.70E-07
Vinyl chloride	1.80E-05	1.39E-04
o-Xylene	2.50E-05	1.93E-04
Total HAPs	-	**2.99E-01**

Notes:

1. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-1 -bark and wet wood (4/22).

2. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-2 -bark and wet wood (4/22).

3. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-3 -bark and wet wood (4/22).

4. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-4 -bark and wet wood (4/22).

5. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

Table 7.1 - RTO Operating Parameters - Normal and Bakeout

Heat Input	Propane Heating Value[1]		Potential Operation	Propane Combustion Limit
MMBtu/hr	Btu/gal	Btu/scf	hr/yr	MMscf/yr
10.2	91,500	2,544	8,040	32.2
40.0	91,500	2,544	24	0.4

Notes:
1. Propane heating value per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion.

Table 7.2 - RTO Potential Emissions

Pollutant	Propane Emission Factor[1]		Normal - Potential Emissions[9]	Bakeout - Potential Emissions[9]
	lb/1,000 gal	lb/MMscf	STPY	STPY
Pollutants and Greenhouse Gases (GHG)				
CO	7.5	208.5	3.36	0.04
NOx	13.0	361.4	5.83	0.07
Filterable PM	0.20	5.6	0.09	1.05E-03
Condensable PM	0.50	13.9	0.22	2.62E-03
Total PM[2]	0.70	19.5	0.31	3.67E-03
Total PM_{10}[2]	0.70	19.5	0.31	3.67E-03
Total $PM_{2.5}$[2]	0.70	19.5	0.31	3.67E-03
SO_2[3]	0.1S	0.4	6.72E-03	7.87E-05
VOC	1.0	27.8	4.48E-01	5.25E-03
Lead[4]	-	5.00E-04	8.06E-06	9.43E-08
CO_2	12,500	347,512	5,602	65.57
CH_4	0.20	5.6	0.09	1.05E-03
N_2O	0.90	25.0	0.40	4.72E-03
CO_2e[6]	12,773	355,107	5,724	67.01
Hazardous Air Pollutants (HAP)[4]				
Arsenic Compounds	7.19E-06	2.00E-04	3.22E-06	3.77E-08
Benzene	7.55E-05	2.10E-03	3.39E-05	3.96E-07
Beryllium Compounds	4.32E-07	1.20E-05	1.93E-07	2.26E-09
Cadmium	3.96E-05	1.10E-03	1.77E-05	2.08E-07
Chromium Compounds	5.04E-05	1.40E-03	2.26E-05	2.64E-07
Cobalt Compounds(CoC)	3.02E-06	8.40E-05	1.35E-06	1.59E-08
Formaldehyde	2.70E-03	7.50E-02	1.21E-03	1.42E-05
Hexane	6.47E-02	1.8	2.90E-02	3.40E-04
Manganese	1.37E-05	3.80E-04	6.13E-06	7.17E-08
Mercury	9.35E-06	2.60E-04	4.19E-06	4.91E-08
Naphthalene	2.19E-05	6.10E-04	9.83E-06	1.15E-07
Nickel Compounds	7.55E-05	2.10E-03	3.39E-05	3.96E-07
Selenium Compounds	8.63E-07	2.40E-05	3.87E-07	4.53E-09
Toluene(Methylbenzene)	1.22E-04	3.40E-03	5.48E-05	6.42E-07
2-Methylnaphthalene[7]	8.63E-07	2.40E-05	3.87E-07	4.53E-09
3-Methylchloranthrene[8]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
7,12-Dimethylbenzo(a)anthr	5.76E-07	1.60E-05	2.58E-07	3.02E-09
Acenaphthene[7]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Acenaphthylene[7]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Anthracene[7]	8.63E-08	2.40E-06	3.87E-08	4.53E-10
Benzo(a)anthracene[8]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Benzo(a)pyrene[8]	4.32E-08	1.20E-06	1.93E-08	2.26E-10
Benzo(b)fluoranthene[8]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Benzo(k)fluoranthene)[8]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Benzo(g,h,i)perylene[7]	4.32E-08	1.20E-06	1.93E-08	2.26E-10
Chrysene(Benzo(a)phenantl	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Dibenzo(a,h)anthracene[8]	4.32E-08	1.20E-06	1.93E-08	2.26E-10
Fluoranthene[7]	1.08E-07	3.00E-06	4.84E-08	5.66E-10
Fluorene[7]	1.01E-07	2.80E-06	4.51E-08	5.28E-10
Indeno(1,2,3-cd)pyrene[8]	6.47E-08	1.80E-06	2.90E-08	3.40E-10
Phenanathrene[7]	6.11E-07	1.70E-05	2.74E-07	3.21E-09
Pyrene[7]	1.80E-07	5.00E-06	8.06E-08	9.43E-10
Total HAPs	-	-	**3.04E-02**	**3.56E-04**

Notes:
1. Emission factor for propane per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion where available. Where unavailable emission factor for propane, assumed per AP-42 Section 1.4 Natural Gas Combustion.
2. Emission factor is the sum of the filterable PM and condensable PM. For conservatism, it is assumed total PM = total PM_{10} = total $PM_{2.5}$.
3. SO2 emission factor is 0.10S. S equals the sulfur content expressed in gr/100 scf gas vapor. Assume a sulfur content of 0.15 gr/100 scf.
4. Emission factors lead and HAP are not listed in AP-42 Section 1.5 Liquefied Petroleum Gas Combustion. Emission factors assumed from AP-42 Section 1.4 Natural Gas Combustion.
5. RTO control effiiciency per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility.
6. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:
   - CO_2 1
   - CH_4 25
   - N_2O 298
7. Polycyclic Organic Matter (POM)
8. Polycyclic Aromatic Compounds (PAC)
9. Emissions for CO, NOx, Filterable PM, SO2 and VOC are included in the dryer emissions.

Table 8.1 - Dry Material Storage Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Dry Chip Storage	946,312

Notes:
1. Annual throughput based on maxium dry hammermill throughput.

Table 8.2 - Raw Material Handling Emission Factors

Pollutant	Emission Factor[1]
	lb/ton
Filterable PM	3.64E-04
Filterable PM_{10}	1.72E-04
Filterable $PM_{2.5}$	2.61E-05

Notes:
1. PM emisson factors for receiving and storage calculated using continuous drop point equation from AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (11/06).

$$E = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:

E = emission factor (lb/ton)

k = particle size mulitiplier (dimensionless)

k (PM)	0.74
k (PM_{15})	0.48
k (PM_{10})	0.35
k (PM_{5})	0.20
k ($PM_{2.5}$)	0.053
U = mean wind speed (mph)	6.7
M = material moisture content (%)	10

Table 8.3 - Potential Emissions from Raw Material Handling

Emission Source	Filterable PM	Filterable PM_{10}	Filterable $PM_{2.5}$
	STPY	STPY	STPY
Dry Chip Storage	1.72E-01	8.15E-02	1.23E-02

Table 8.4 - Dry Material Storage Potential Emissions

Pollutant	Emission Factor[1]	Potential Emissions
	lb/ton	STPY
VOC	0.12	56.8
Acetaldehyde	1.00E-03	0.47
Formaldehyde	2.00E-03	0.95
Methanol	1.95E-03	0.92
Total HAP	-	2.34

Notes:
1. Emission factor per GAEPD recommendation for storage/handling at wood pellet manufacturing facility.

Table 9.1 - Dry Hammermill Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Dry Hammermills	946,312

Notes:
1. Annual throughput based on maxium dry hammermill throughput.

Table 9.2 - Dry Hammermill Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Dry Hammermill Air Systems	100,000	2.00E-02	17.1	68.9

Table 9.3 - Dry Hammermill Potential VOC and HAP Emissions

Pollutant	Emission Factor	Control Efficiency[4]	Potential Emissions
	lb/ton	%	STPY
VOC[1]	2.5	95	59.1
Acetaldehyde[1]	4.00E-03	95	0.09
Formaldehyde[1]	8.00E-03	95	0.19
Methanol[1]	4.00E-03	95	0.09
Acrolein[2]	0	95	0.00
Phenol[3]	4.50E-03	95	0.11
Propionaldehyde[2]	0	95	0.00
Total HAP	-	-	0.48

Notes:
1. Emission factor per GAEPD recommendation for hammermill at wood pellet manufacturing facility.
2. Emission factor below detectable limit per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
3. Emission factor from AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
4. Emissions from dry hammermills are routed to an RCO. RCO control efficiency for VOC per vendor documentation. RCO control efficiency for HAP assumed to be same as for VOC.

Table 10.1 - Pelleting System Operating Parameters

Emission Source	Annual Throughput Wet[1]	Pellet Density	Volumetric Throughput
	STPY	lb/ft^3	ft^3/yr
Pellet Mill	877,753	40	43,887,631
Pellet Cooler	877,753	40	43,887,631

Notes:
1. Annual throughput based on maxium pellet mill throughput.

Table 10.2 - Pelleting System Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Pellet Cooler Air System	100,000	2.00E-03	1.7	6.9

Table 10.3 - Pelleting System Potential VOC and HAP Emissions

Pollutant	Emission Factor		Control Efficiency[4]	Potential Emissions
	lb/ton	lb/ft^3	%	STPY
VOC[1]	0.5	-	95	11.0
Acetaldehyde[1]	1.00E-03	-	95	2.19E-02
Formaldehyde[1]	2.00E-03	-	95	4.39E-02
Methanol[1]	1.00E-03	-	95	2.19E-02
Acrolein[2]	-	5.84E-06	95	6.41E-03
Phenol[2]	-	1.07E-04	95	0.12
Propionaldehyde[3]	0	-	95	0.00
Total HAP	-	-	-	0.21

Notes:
1. Emission factor per GAEPD recommendation for pelletizer / pellet cooler at wood pellet manufacturing facility.
2. Emission factor per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-6 for board cooler, UF resin at particleboard manufacturing facility. Emission factor is converted from lb/MSF 3/4 to kg/m^3 per footnote a of Table 10.6.2-6, then converted to lb/ft^3.
3. Emission factor below detectable limit per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-6 for board cooler, UF resin at particleboard manufacturing facility.
4. Emissions from pelleting system are routed to an RCO. RCO control efficiency for VOC per vendor documentation. RCO control efficiency for HAP assumed to be same as for VOC.

Table 11.1 - Pellet Storage Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Pellet Storage	771,618

Notes:
1. Annual throughput based on finished pellet production capacity.

Table 11.2 - Pellet Storage and Loadout Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Pellet Storage - Vent Fan	8,105	1.00E-02	0.7	2.8
Pellet Storage - High Temp Fans	0	1.00E-02	0.0	0.0
Recirculation Cyclo-Filter	50,000	2.00E-03	0.9	3.4

Table 11.3 - Pellet Storage Potential VOC and HAP Emissions

Pollutant	Emission Factor	Control Efficiency	Potential Emissions[2]
	lb/ton	%	STPY
VOC[1]	0.4	95	7.7
Acetaldehyde[1]	1.00E-03	95	0.02
Formaldehyde[1]	2.00E-03	95	0.04
Methanol[1]	1.00E-03	95	0.02
Total HAP	-	-	0.08

Notes:
1. Emission factor per GAEPD recommendation for storage/handling at wood pellet manufacturing facility.
2. Emissions are for all pellet storage and handling on site.

Table 12.1 - RCO Operating Parameters - Normal and Bakeout

Heat Input	Propane Heating Value[1]		Potential Operation	Propane Combustion Limit
MMBtu/hr	Btu/gal	Btu/scf	hr/yr	MMscf/yr
8.3	91,500	2,544	8,040	26.2
25.0	91,500	2,544	24	0.2

Notes:
1. Propane heating value per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion.

Table 12.2 - RCO Potential Emissions

Pollutant	Propane Emission Factor[1]		Normal - Potential Emissions[9]	Bakeout - Potential Emissions[9]
	lb/1,000 gal	lb/MMscf	STPY	STPY
Pollutants and Greenhouse Gases (GHG)				
CO	7.5	208.5	2.73	0.02
NOx	13.0	361.4	4.74	0.04
Filterable PM	0.20	5.6	0.07	6.56E-04
Condensable PM	0.50	13.9	0.18	1.64E-03
Total PM^{2}	0.70	19.5	0.26	2.30E-03
Total PM_{10}[2]	0.70	19.5	0.26	2.30E-03
Total $PM_{2.5}$[2]	0.70	19.5	0.26	2.30E-03
SO_2[3]	0.1S	0.4	0.01	4.92E-05
VOC[4]	1.0	27.8	0.36	3.28E-03
Lead[4]	-	5.00E-04	6.56E-06	5.90E-08
CO_2	12,500	347,512	4,558	40.98
CH_4	0.20	5.6	0.07	6.56E-04
N_2O	0.90	25.0	0.33	2.95E-03
CO_2e[6]	12,773	355,107	4,658	41.88
Hazardous Air Pollutants (HAP)[4]				
Arsenic Compounds	7.19E-06	2.00E-04	2.62E-06	2.36E-08
Benzene	7.55E-05	2.10E-03	2.75E-05	2.48E-07
Beryllium Compounds	4.32E-07	1.20E-05	1.57E-07	1.42E-09
Cadmium	3.96E-05	1.10E-03	1.44E-05	1.30E-07
Chromium Compounds	5.04E-05	1.40E-03	1.84E-05	1.65E-07
Cobalt Compounds(CoC)	3.02E-06	8.40E-05	1.10E-06	9.91E-09
Formaldehyde	2.70E-03	7.50E-02	9.84E-04	8.85E-06
Hexane	6.47E-02	1.8	2.36E-02	2.12E-04
Manganese	1.37E-05	3.80E-04	4.98E-06	4.48E-08
Mercury	9.35E-06	2.60E-04	3.41E-06	3.07E-08
Naphthalene	2.19E-05	6.10E-04	8.00E-06	7.19E-08
Nickel Compounds	7.55E-05	2.10E-03	2.75E-05	2.48E-07
Selenium Compounds	8.63E-07	2.40E-05	3.15E-07	2.83E-09
Toluene(Methylbenzene)	1.22E-04	3.40E-03	4.46E-05	4.01E-07
2-Methylnaphthalene[7]	8.63E-07	2.40E-05	3.15E-07	2.83E-09
3-Methylchloranthrene[8]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
7,12-Dimethylbenzo(a)anthra	5.76E-07	1.60E-05	2.10E-07	1.89E-09
Acenaphthene[7]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Acenaphthylene[7]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Anthracene[7]	8.63E-08	2.40E-06	3.15E-08	2.83E-10
Benzo(a)anthracene[8]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Benzo(a)pyrene[8]	4.32E-08	1.20E-06	1.57E-08	1.42E-10
Benzo(b)fluoranthene[8]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Benzo(k)fluoranthene)[8]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Benzo(g,h,i)perylene[7]	4.32E-08	1.20E-06	1.57E-08	1.42E-10
Chrysene(Benzo(a)phenanth	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Dibenzo(a,h)anthracene[8]	4.32E-08	1.20E-06	1.57E-08	1.42E-10
Fluoranthene[7]	1.08E-07	3.00E-06	3.94E-08	3.54E-10
Fluorene[7]	1.01E-07	2.80E-06	3.67E-08	3.30E-10
Indeno(1,2,3-cd)pyrene[8]	6.47E-08	1.80E-06	2.36E-08	2.12E-10
Phenanathrene[7]	6.11E-07	1.70E-05	2.23E-07	2.00E-09
Pyrene[7]	1.80E-07	5.00E-06	6.56E-08	5.90E-10
Total HAPs	-	-	**2.47E-02**	**2.23E-04**

Notes:
1. Emission factor for propane per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion where available. Where unavailable emission factor for natural gas assumed per AP-42 Section 1.4 Natural Gas Combustion.
2. Emission factor is the sum of the filterable PM and condensable PM. For conservatism, it is assumed total PM = total PM_{10} = total $PM_{2.5}$.
3. SO2 emission factor is 0.10S. S equals the sulfur content expressed in gr/100 scf gas vapor. Assume a sulfur content of 0.15 gr/100 scf.
4. Emission factor for VOC, lead and HAP are not listed in AP-42 Section 1.5 Liquefied Petroleum Gas Combustion. Emission factor assumed is per AP-42 Section 1.4 Natural Gas Combustion.
5. RCO control effiiciency for CO per EPA-452/F-03-021 Air Pollution Control Technology Fact Sheet. RCO control efficiency for VOC per vendor documentation. RCO control efficiency for HAP assumed to be same as for VOC.
6. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

7. Polycyclic Organic Matter (POM)
8. Polycyclic Aromatic Compounds (PAC)

Table 13.1 - Diesel Fire Pump Operating Parameters

Maximum Power Output[1]	Potential Operation	Maximum Heat Input
HP	hr/yr	MMBtu/hr
150	200	1.05

Notes:
1. Estimated HP based on flow required.

Table 13.2 - Diesel Fire Pump Potential Emissions

Pollutant	Emission Factor[1]		Potential Emissions
	lb/hp-hr	lb/MMBtu	STPY
Pollutants and Greenhouse Gases (GHG)			
CO	6.68E-03	0.95	0.10
NOx	3.10E-02	4.41	0.47
Filterable PM^2	2.20E-03	0.31	0.03
Total PM^2	2.20E-03	0.31	0.03
Total PM_{10}[2]	2.20E-03	0.31	0.03
Total $PM_{2.5}$[2]	2.20E-03	0.31	0.03
SO_2	2.05E-03	0.29	0.03
VOC	2.47E-03	0.35	0.04
CO_2	1.15	164.0	17.3
CH_4[3]	4.63E-05	6.61E-03	0.00
N_2O[3]	9.26E-06	1.32E-03	0.00
CO_2e[4]	1.15	164.6	17.31
Hazardous Air Pollutants (HAP)			
Benzene	6.53E-06	9.33E-04	9.80E-05
Toluene	2.86E-06	4.09E-04	4.29E-05
Xylenes	2.00E-06	2.85E-04	2.99E-05
Propylene	1.81E-05	2.58E-03	2.71E-04
1,3-Butadiene	2.74E-07	3.91E-05	4.11E-06
Formaldehyde	8.26E-06	1.18E-03	1.24E-04
Acetaldehyde	5.37E-06	7.67E-04	8.05E-05
Acrolein	6.48E-07	9.25E-05	9.71E-06
Naphthalene[5]	5.94E-07	8.48E-05	8.90E-06
Acenaphthylene[5]	3.54E-08	5.06E-06	5.31E-07
Acenaphthene[5]	9.94E-09	1.42E-06	1.49E-07
Fluorene[5]	2.04E-07	2.92E-05	3.07E-06
Phenanthrene[5]	2.06E-07	2.94E-05	3.09E-06
Anthracene[5]	1.31E-08	1.87E-06	1.96E-07
Fluoranthene[5]	5.33E-08	7.61E-06	7.99E-07
Pyrene[5]	3.35E-08	4.78E-06	5.02E-07
Benzo(a)anthracene[5]	1.18E-08	1.68E-06	1.76E-07
Chrysene[5]	2.47E-09	3.53E-07	3.71E-08
Benzo(b)fluoranthene[5]	6.94E-10	9.91E-08	1.04E-08
Benzo(k)fluoranthene[5]	1.09E-09	1.55E-07	1.63E-08
Benzo(a)pyrene[5]	1.32E-09	1.88E-07	1.97E-08
Indeno(1,2,3-cd)pyrene[5]	2.63E-09	3.75E-07	3.94E-08
Dibenz(a,h)anthracene[5]	4.08E-09	5.83E-07	6.12E-08
Benzo(g,h,I)perylene[5]	3.42E-09	4.89E-07	5.13E-08
Total HAPs	-	-	**6.78E-04**

Notes:
1. Emission factor per AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Table 3.3-1 and 3.3-2 (10/96).
2. For conservatism, it is assumed filterable PM = total PM = total PM_{10} = total $PM_{2.5}$.
3. Emission factor for CH_4 and N_2O per 40 CFR Part 98, Table C-2 for petroleum fuels.
4. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

5. Polycyclic Aromatic Hydrocarbons (PAH)

Golden State Natural Resources Forest Resiliency Demonstration Project

Railroad Emissions Summary

Table 1. Line Haul Emissions - Annual

Scenario	Emissions (tons per year)[1]						
	ROG	NOx	CO	SOx	PM10	PM2.5	CO_2e (MT/year)
Lassen Processing Facility to Port of Stockton							
Inbound Running	0.52	12.38	2.99	0.01	0.28	0.26	1,051.11
Idling at Lassen Facility	0.01	0.13	0.03	0.00	0.00	0.00	10.82
Outbound Running	1.87	44.33	10.72	0.04	1.01	0.93	3,762.67
Idling at Port	0.01	0.13	0.03	0.00	0.00	0.00	10.82
Subtotal	***2.41***	***56.97***	***13.77***	***0.05***	***1.30***	***1.20***	***4,835.42***
Tuolumne Processing Facility to Port of Stockton							
Inbound Running	0.03	0.81	0.20	0.00	0.02	0.02	68.48
Idling at Tuolumne Facility	0.00	0.07	0.02	0.00	0.00	0.00	6.18
Outbound Running	0.16	3.75	0.91	0.00	0.09	0.08	318.02
Idling at Port	0.00	0.07	0.02	0.00	0.00	0.00	6.18
Subtotal	***0.20***	***4.70***	***1.14***	***0.00***	***0.11***	***0.10***	***398.86***
Total Emissions by Air District							
Lassen County APCD	0.63	14.93	3.61	0.01	0.34	0.31	1,267.17
Northern Sierra AQMD	0.57	13.57	3.28	0.01	0.31	0.29	1,152.17
Butte County AQMD	0.41	9.74	2.36	0.01	0.22	0.20	827.09
Feather River AQMD	0.33	7.89	1.91	0.01	0.18	0.17	669.61
Sacramento Metropolitan AQMD	0.27	6.48	1.57	0.01	0.15	0.14	550.03
Tuolumne County APCD	0.03	0.70	0.17	0.00	0.02	0.01	59.30
San Joaquin Valley APCD	0.39	9.24	2.23	0.01	0.21	0.19	784.06
Total Annual Emissions	**2.61**	**61.67**	**14.91**	**0.06**	**1.41**	**1.30**	**5,234.28**

1. All annual emissions are in units of short tons per year, except for CO2e, which is in metric tons per year

Table 2. Line Haul Emissions - Maximum Day

Scenario	Emissions (pounds per day)					
	ROG	NOx	CO	SOx	PM10	PM2.5
Lassen Processing Facility to Port of Stockton						
Inbound Running	14.96	353.81	85.53	0.33	8.08	7.43
Idling at Lassen Facility	0.15	3.64	0.88	0.00	0.08	0.08
Outbound Running	53.56	1,266.55	306.17	1.19	28.92	26.61
Idling at Port	0.15	3.64	0.88	0.00	0.08	0.08
Subtotal	***68.82***	***1,627.65***	***393.46***	***1.53***	***37.16***	***34.19***
Tuolumne Processing Facility to Port of Stockton						
Inbound Running	0.28	6.72	1.63	0.01	0.15	0.14
Idling at Tuolumne Facility	0.03	0.61	0.15	0.00	0.01	0.01
Outbound Running	1.32	31.22	7.55	0.03	0.71	0.66
Idling at Port	0.03	0.61	0.15	0.00	0.01	0.01
Subtotal	***1.66***	***39.16***	***9.47***	***0.04***	***0.89***	***0.82***
Total Emissions by Air District						
Lassen County APCD	18.04	426.54	103.11	0.40	9.74	8.96
Northern Sierra AQMD	16.40	387.83	93.75	0.37	8.86	8.15
Butte County AQMD	11.77	278.41	67.30	0.26	6.36	5.85
Feather River AQMD	9.53	225.40	54.49	0.21	5.15	4.73
Sacramento Metropolitan AQMD	7.83	185.15	44.76	0.17	4.23	3.89
Tuolumne County APCD	0.25	5.82	1.41	0.01	0.13	0.12
San Joaquin Valley APCD	7.74	182.96	44.23	0.17	4.18	3.84
Maximum Day Emissions	**70.48**	**1,666.81**	**402.92**	**1.57**	**38.06**	**35.01**

1. Max day assumes one train would travel to/from each pellet facility

Table 3. Lassen Facility Switcher Locomotive Emissions - Annual - Unmitigated

Scenario	Emissions (tons per year)[1,2,3]						
	ROG	NOx	CO	SOx	PM10	PM2.5	CO_2e (MT/year)
Running	0.02	0.37	0.04	0.00	0.01	0.01	17.41
Idling	0.00	0.00	0.00	0.00	0.00	0.00	0.12
Total Annual Emissions	***0.02***	***0.37***	***0.04***	***0.00***	***0.01***	***0.01***	***17.54***

1. All annual emissions are in units of short tons per year, except for CO2e, which is in metric tons per year

2. Assumes switchers would operate 70 days per year for trains at the Lassen facility (i.e., 70 trains/year)

3. Assumes Pre-Tier engine for the Lassen switcher based on Statewide Average

Table 4. Lassen Facility Switcher Locomotive Emissions - Maximum Day - Unmitigated

	Emissions (pounds per day)[1]					
Scenario	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Running	0.47	10.52	1.04	0.01	0.26	0.24
Idling	0.00	0.07	0.01	0.00	0.00	0.00
Maximum Day Emissions	***0.47***	***10.59***	***1.04***	***0.01***	***0.26***	***0.24***

1. Assumes Pre-Tier engine for the Lassen switcher based on Statewide Average

Table 5. Lassen Facility Switcher Locomotive Emissions - Annual - Mitigated

	Emissions (tons per year)[1,2,3]						
Scenario	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**CO_2e (MT/year)**
Running	0.00	0.03	0.04	0.00	0.00	0.00	12.73
Idling	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Total Annual Emissions	***0.00***	***0.03***	***0.04***	***0.00***	***0.00***	***0.00***	***12.81***

1. All annual emissions are in units of short tons per year, except for CO2e, which is in metric tons per year

2. Assumes switchers would operate 70 days per year for trains at the Lassen facility (i.e., 70 trains/year)

3. Assumes Tier 4 engine for the Lassen switcher under the mitigated scenario

Table 6. Lassen Facility Switcher Locomotive Emissions - Maximum Day - Mitigated

	Emissions (pounds per day)[1]					
Scenario	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
Running	0.04	0.81	1.04	0.00	0.02	0.01
Idling	0.00	0.01	0.01	0.00	0.00	0.00
Maximum Day Emissions	***0.04***	***0.81***	***1.04***	***0.00***	***0.02***	***0.01***

1. Assumes Tier 4 engine for the Lassen switcher under the mitigated scenario

Table 7. Port of Stockton Switcher Locomotive Emissions - Annual

	Emissions (tons per year)[1,2,3]						
Scenario	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**	**CO_2e (MT/year)**
For Material from Lassen Processing Facility							
Running	0.01	0.11	0.03	0.00	0.00	0.00	13.80
Idling	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Subtotal	***0.01***	***0.11***	***0.03***	***0.00***	***0.00***	***0.00***	***13.89***
For Material from Tuolumne Processing Facility							
Running	0.02	0.38	0.12	0.00	0.01	0.01	47.31
Idling	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Subtotal	***0.03***	***0.39***	***0.12***	***0.00***	***0.01***	***0.01***	***47.64***
Total Annual Emissions	**0.03**	**0.50**	**0.15**	**0.00**	**0.02**	**0.02**	**61.53**

1. All annual emissions are in units of short tons per year, except for CO2e, which is in metric tons per year

2. Assumes switchers would operate 70 days per year for trains from Lassen (i.e., 70 trains/year) and 240 days per year for trains from Tuolumne (i.e., 240 trains/year)

2. Emission factors based on average switcher engine emissions at Port

Table 8. Port of Stockton Switcher Locomotive Emissions - Maximum Day

	Emissions (pounds per day)					
Scenario	**ROG**	**NOx**	**CO**	**SOx**	**PM10**	**PM2.5**
For Material from Lassen Processing Facility						
Running	0.21	3.19	0.97	0.00	0.11	0.10
Idling	0.00	0.02	0.01	0.00	0.00	0.00
Subtotal	***0.21***	***3.22***	***0.98***	***0.00***	***0.11***	***0.10***
For Material from Tuolumne Processing Facility						
Running	0.21	3.19	0.97	0.00	0.11	0.10
Idling	0.00	0.02	0.01	0.00	0.00	0.00
Subtotal	***0.21***	***3.22***	***0.98***	***0.00***	***0.11***	***0.10***
Maximum Day Emissions	**0.42**	**6.43**	**1.96**	**0.01**	**0.22**	**0.21**

Golden State Natural Resources Forest Resiliency Demonstration Project

Railroad Emissions Factors and Assumptions

Conversions:

1 lb = 453.6 g

1 MT = 1.102311 ton

Table AQ-1. Fleet Average Class I (Line Haul) Emission Factors

	Emission Factors (lb/gallon)[1,2]									
Year	ROG	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O	CO2e
2025	0.01027	0.24281	0.05870	0.00023	0.00554	0.00510	22.52460	0.00092	0.00057	22.71848

1. Emission factors based on CARB's 2021 Line-Haul Emission Inventory

2. Converted the tons per day of each pollutant and total gallons per year by air district into a pound per gallon emission factor

3. N2O emission factors based on 0.26 g/gallon (Rail - Diesel Fuel) from The Climate Registry 2023 Default Emission Factors

Table AQ-2. Project Assumptions for Line Haul to Port of Stockton

Parameter	Values	Units	Notes
Lassen Processing Facility			
Annual Pellets Produced	771,618	tons	Project Description (700,000 MT)
Number of Trains per Year	70	trains	Project Description
Cars per Train	100	cars/train	Project Description
Weight of Empty Rail Car	30.25	tons/car	Based on Trinity Rail Estimate
Weight of Pellets Transported	110.23	tons/car	Project Description
Locomotives per Train	6	locomotive/train	Project Description
Weight of Locomotive	208	tons/locomotive	Based on Trammel Crow Project EIR for Port of Stockton
Net Aggregated Fuel Consumption Index	868	ton-mile/gal	Based on Trammel Crow Project EIR for Port of Stockton
Miles Traveled	296	miles/one-way	Based on GIS data
Trip Rate	7,000	cars/year	70 Trains/Year per Project Description
Locomotive Idling	420	hours/year	70 Trains/Year, 1 hour idling each at facility and Port
Project Fuel Consumption (Inbound)	102,000.65	gal/year	Inbound = Empty Train from Port
Project Fuel Consumption (Outbound)	365,132.95	gal/year	Outbound = Train + Pellets to Port
Project Fuel Consumption (Idling)	2,100.00	gal/year	5 gal/hour; CARB 2016 Technology Assessment Freight Locomotives
% Train Travel in Lassen County APCD	26.21%		Based on GIS data
% Train Travel in Northern Sierra AQMD	23.83%		Based on GIS data
% Train Travel in Butte County AQMD	17.10%		Based on GIS data
% Train Travel in Feather River AQMD	13.85%		Based on GIS data
% Train Travel in Sacramento Metropolitan AQMD	11.38%		Based on GIS data
% Train Travel in San Joaquin Valley APCD	9.19%		Based on GIS data
Tuolumne Processing Facility			
Annual Pellets Produced	330,693	tons	Project Description (300,000 MT)
Number of Manifest Trains per Year - Average	240	trains	Adding cars to existing manifest trains each day
Cars per Train - Average	13	cars/train	Project Description
Weight of Empty Rail Car	30.25	tons/car	Based on Trinity Rail Estimate
Weight of Materials Imported	110.23	tons/car	Project Description
Locomotives per Train	0	locomotive/train	Adding cars to existing manifest trains
Weight of Locomotive	208	tons/locomotive	Based on Trammel Crow Project EIR for Port of Stockton
Net Aggregated Fuel Consumption Index	868	ton-mile/gal	Based on Trammel Crow Project EIR for Port of Stockton
Miles Traveled	64	miles/one-way	Based on GIS Maps
Trip Rate	3,000	cars/year	Project Description
Locomotive Idling	240	hours/year	240 Trains/Year, 1 hour idling at facility (new stop)
Project Fuel Consumption (Inbound)	6,645.24	gal/year	Inbound = Empty Train from Port
Project Fuel Consumption (Outbound)	30,860.53	gal/year	Outbound = Train + Pellets to Port
Project Fuel Consumption (Idling)	1,200	gal/year	5 gal/hour; CARB 2016 Technology Assessment Freight Locomotives
% Train Travel in Tuolumne County APCD	14.87%		Based on GIS data
% Train Travel in San Joaquin Valley APCD	85.13%		Based on GIS data

Table AQ-3. Class III (Switcher) Emission Factors

	Emission Factors (g/bhp-hr)[1]				Conversion Factor	Emission Factors (g/gal)			
Tier	PM10	HC	NOx	CO	bhp-hr/gal fuel	PM10	HC	NOx	CO
Pre-Tier	0.32	0.48	13.00	1.28	15.20	4.86	7.30	197.60	19.46
Tier 0	0.32	0.48	8.60	1.28	15.20	4.86	7.30	130.72	19.46
Tier 0+	0.20	0.30	7.20	1.28	18.20	3.64	5.46	131.04	23.30
Tier 1	0.32	0.47	6.70	1.28	18.20	5.82	8.55	121.94	23.30
Tier 1+	0.20	0.29	6.70	1.28	18.20	3.64	5.28	121.94	23.30
Tier 2	0.18	0.26	4.95	1.28	20.80	3.74	5.41	102.96	26.62
Tier 2+	0.08	0.13	4.95	1.28	20.80	1.66	2.70	102.96	26.62
Tier 3	0.08	0.13	5.00	1.28	20.80	1.66	2.70	104.00	26.62
Tier 4	0.02	0.04	1.00	1.28	20.80	0.42	0.83	20.80	26.62

1. Emission factors based on CARB's 2017 Short Line/Class III Documentation, Table 5.1 and Table 5.2

Table AQ-4. EPA Default Power Distribution for Switcher Locomotives

	Rated Horsepower	Average Time in Notch[1]	Power in Notch[1]	Average Time in Running Notch	
Throttle Position	bhp	%	bhp	%	Load Factor
Dynamic Brake	1,500	0.0%	70	--	0.047
Idle	1,500	59.8%	15	--	0.010
1	1,500	12.4%	72	30.8%	0.048
2	1,500	12.3%	233	30.6%	0.155
3	1,500	5.8%	440	14.4%	0.293
4	1,500	3.6%	569	9.0%	0.379
5	1,500	3.6%	885	9.0%	0.590
6	1,500	1.5%	1,109	3.7%	0.739
7	1,500	0.2%	1,372	0.5%	0.915
8	1,500	0.8%	1,586	2.0%	1.057
Weighted Average Load Factor for Switcher in Running Mode					**0.245**

1. Average time in notch and power in notch based on EPA's Locomotive Emission Standards Regulatory Support Document (1998), Table 4-4 and Appendix B.

Table AQ-5. Class III (Switcher) Emission Factors at Lassen Processing Facility - Unmitigated

		Emission Factors (lb/gallon)[1,2]									
Engine	Number	ROG	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O	CO2e
State Average - Pre-Tier	1	0.01946	0.43563	0.04289	0.00023	0.01072	0.00987	22.52460	0.00092	0.00057	22.71848

1. Emission factors for PM10, NOx, and CO derived from AQ-3 (converting grams to pounds/gal). For locomotive operations, the emission factor for PM2.5 is 92% of PM10 and ROG is 1.21 times the emission factor for hydrocarbons (HC), per CARB's 2017 Short Line/Class III Documentation.

2. Emission factors for SOx, CO2, and CH4 based on Class I (Line Haul) data in Table AQ-1. N2O emission factors based on 0.26 g/gallon (Rail - Diesel Fuel) from The Climate Registry 2023 Default Emission Factors. CO2e based on the Global Warming Potentials of CO2 (1), CH4 (25), and N2O (298)

Table AQ-6. Class III (Switcher) Emission Factors at Lassen Processing Facility - Mitigated

		Emission Factors (lb/gallon)[1,2]									
Engine Tier	Number	ROG	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O	CO2e
Tier 4	1	0.00222	0.04586	0.05869	0.00023	0.00092	0.00084	22.52460	0.00092	0.00057	22.71848

1. Emission factors for PM10, NOx, and CO derived from AQ-3 (converting grams to pounds/gal). For locomotive operations, the emission factor for PM2.5 is 92% of PM10 and ROG is 1.21 times the emission factor for hydrocarbons (HC), per CARB's 2017 Short Line/Class III Documentation.

2. Emission factors for SOx, CO2, and CH4 based on Class I (Line Haul) data in Table AQ-1. N2O emission factors based on 0.26 g/gallon (Rail - Diesel Fuel) from The Climate Registry 2023 Default Emission Factors. CO2e based on the Global Warming Potentials of CO2 (1), CH4 (25), and N2O (298)

Table AQ-7. Lassen Facility Switcher Assumptions

Parameter	Values	Units	Notes
Statewide Average Switcher			
Engine Tier	Pre-Tier		
Engine Horsepower	1,500	hp	HP based on Trammel Crow Project EIR for Port of Stockton
Load Factor - Running	0.245		From Table AQ-4
Load Factor - Idling	0.010		From Table AQ-4
Fuel Usage - Running	24.14	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-3
Fuel Usage - Idling	0.99	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-4
Tier 4 Switcher			
Engine Tier	Tier 4		
Engine Horsepower	1,500	hp	HP based on Trammel Crow Project EIR for Port of Stockton
Load Factor - Running	0.245		From Table AQ-4
Load Factor - Idling	0.010		From Table AQ-4
Fuel Usage - Running	17.64	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-3
Fuel Usage - Idling	0.72	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-4
Switcher Engine Mode and Operations			
Engines/Train	1		
Daily Operation - Running	1.00	hours/day	Based on Trammel Crow Project EIR for Port of Stockton
Daily Operation - Idling	0.17	hours/day	Based on Trammel Crow Project EIR for Port of Stockton
Annual Operation - for Lassen Trains	70.00	days/year	Project Description (assuming 1 train/day)

Table AQ-8. Class III (Switcher) Emission Factors at Port of Stockton

			Emission Factors (lb/gallon)[1,2]									
Engine Model	Engine Tier	Number at Port	ROG	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O	CO2e
SW1500	Tier 0	3	0.01946	0.28818	0.04289	0.00023	0.01072	0.00987	22.52460	0.00092	0.00057	22.71848
Brookville Genset	Tier 4	3	0.00222	0.04586	0.05869	0.00023	0.00092	0.00084	22.52460	0.00092	0.00057	22.71848
Weighted Average	--	**All**	**0.01084**	**0.16702**	**0.05079**	**0.00023**	**0.00582**	**0.00535**	**22.52460**	**0.00092**	**0.00057**	**22.71848**

1. Emission factors for PM10, NOx, and CO derived from AQ-3 (converting grams to pounds/gal). For locomotive operations, the emission factor for PM2.5 is 92% of PM10 and ROG is 1.21 times the emission factor for hydrocarbons (HC), per CARB's 2017 Short Line/Class III Documentation.

2. Emission factors for SOx, CO2, and CH4 based on Class I (Line Haul) data in Table AQ-1. N2O emission factors based on 0.26 g/gallon (Rail - Diesel Fuel) from The Climate Registry 2023 Default Emission Factors. CO2e based on the Global Warming Potentials of CO2 (1), CH4 (25), and N2O (298)

Table AQ-9. Port of Stockton Switcher Assumptions

Parameter	Values	Units	Notes
SW1500 Engine			
Engine Tier	Tier 0		
Engine Horsepower	1,500	hp	
Load Factor - Running	0.245		From Table AQ-4
Load Factor - Idling	0.010		From Table AQ-4
Fuel Usage - Running	24.14	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-3
Fuel Usage - Idling	0.99	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-4
Brookville Genset			
Engine Tier	Tier 4		
Engine Horsepower	1,200	hp	
Load Factor - Running	0.245		From Table AQ-4
Load Factor - Idling	0.010		From Table AQ-4
Fuel Usage - Running	14.11	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-3
Fuel Usage - Idling	0.58	gal/hour	Based on Tier, HP, Load Factor, and Conversion Factor in Table AQ-4
Average Port Switcher Engine Mode and Operations			
Engines/Train	1		
Average Fuel Use - Running	19.13	gal/hour	Averaged running fuel use for SW1500 and Brookville engines
Average Fuel Use - Idling	0.78	gal/hour	Averaged idling fuel use for SW1500 and Brookville engines
Daily Operation - Running	1.00	hours/day	Based on Trammel Crow Project EIR for Port of Stockton
Daily Operation - Idling	0.17	hours/day	Based on Trammel Crow Project EIR for Port of Stockton
Annual Operation - for Lassen Trains	70.00	days/year	Project Description (assuming 1 train/day)
Annual Operation - for Tuolumne Trains	240.00	days/year	Project Description (assuming 1 train/day)

Table 0.1 - Pellets Storage and Throughputs

Material	Quantity of Equipment	Hourly Throughput Wet	Annual Throughput Dry		Annual Throughput Dry	Moisture Content	Comments
		MTPH	MTPY	STPY	STPY	%	
Pellets Received	-		1,000,000	1,102,311	1,025,149	7	Based on capacity rating of facility.

Table 0.2 - Particulate Collection Operating Parameters

Pick-up Points for Dust Collectors	Quantity of Equipment	Air Flow Each	Air Flow Total	Inlet Loading	Assumed Outlet Loading	Comments
		dscfm	dscfm	gr/dscf	gr/dscf	
Pellet Receiving Baghouse 1	1	8,000	8,000		0.002	ACT Proposal (provided by Nexus). Updated per vendor guarantee
Pellet Receiving Baghouse 2	1	1,000	1,000		0.002	ACT Proposal (provided by Nexus). Updated per vendor guarantee
Pellet Storage Baghouse	1	3,000	3,000		0.002	ACT Proposal (provided by Nexus). Updated per vendor guarantee
Loadout Baghouse 1	1	1,000	1,000		0.002	ACT Proposal (provided by Nexus). Updated per vendor guarantee
Loadout Baghouse 2	1	1,200	1,200		0.002	ACT Proposal (provided by Nexus). Updated per vendor guarantee
Loadout Baghouse 3	1	8,000	8,000		0.002	ACT Proposal (provided by Nexus). Updated per vendor guarantee
Dust Collection Silo	1	1,000	1,000		0.02	ACT Proposal (provided by Nexus)

Table 0.3 - Diesel Fire Pump Operating Parameters

Maximum Power Output		No. of Units	**Total Power**
kW	HP		**HP**
37	50	2	**100**

Table 1.1 - Facility-Wide Emissions

Emission Source	CO	NOx	Filterable PM	Total PM10	Total PM2.5	SO2	VOC	CO2e	Total HAP
	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY
Storage Process									
Pellet Storage & Loadout	-	-	0.90	0.90	0.90	-	-	-	-
Balance of Plant									
Diesel Fire Pump 1	1.67E-02	0.08	5.50E-03	5.50E-03	5.50E-03	5.13E-03	6.18E-03	2.9	1.13E-04
Diesel Fire Pump 2	1.67E-02	0.08	5.50E-03	5.50E-03	5.50E-03	5.13E-03	6.18E-03	2.9	1.13E-04
Facility-Wide Total With Fugitives	3.34E-02	0.16	0.91	0.91	0.91	1.03E-02	1.24E-02	5.8	0.0
Facility-Wide Total Without Fugitives	3.34E-02	0.16	0.91	0.91	0.91	1.03E-02	1.24E-02	5.8	0.0
Title V Major Source Threshold	100	10	100	70	70	70	10	-	25
Above Title V Threshold?	No	No	No	No	No	No	No	-	No
NSR Major Source Threshold	250	10	250	250	70	250	10	75,000	-
Above NA-NSR Threshold?[1]	No	No	No	No	No	No	No	No	-

Notes:

1. A wood pellet storage facility is not considered within a stationary source category as listed in 40 CFR Part 70 State Operating Permit Programs. Therefore, fugitives are excluded from Major Source determination.

Table 2.1 - Pellet Storage Operating Parameters

Emission Source	Annual Throughput Dry
	STPY
Pellet Storage	1,025,149

Table 2.2 - Pellet Storage and Loadout Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM		
	dscfm	gr/dscf	lb/hr	STPY	lbs/day
Pellet Receiving Baghouse 1	8,000	0.00	0.14	0.60	3.29
Pellet Receiving Baghouse 2	1,000	0.00	0.02	0.08	0.41
Pellet Storage Baghouse	3,000	0.00	0.05	0.23	1.23
Loadout Baghouse 1	1,000	0.00	0.02	0.08	0.41
Loadout Baghouse 2	1,200	0.00	0.02	0.09	0.49
Loadout Baghouse 3	8,000	0.00	0.14	0.60	3.29
Dust Collection Silo	1,000	0.02	0.17	0.75	4.11

Table 3.1 - Diesel Fire Pump #1 Operating Parameters

Maximum Power Output[1]	Potential Operation	Maximum Heat Input
HP	hr/yr	MMBtu/hr
50	100	0.35

Notes:
1. Estimated HP based on flow required.

Table 3.2 - Diesel Fire Pump #1 Potential Emissions

Pollutant	Emission Factor[1]		Potential Emissions	
	lb/hp-hr	lb/MMBtu	STPY	lbs/day
Pollutants and Greenhouse Gases (GHG)				
CO	6.68E-03	0.95	0.02	0.09
NOx	3.10E-02	4.41	0.08	0.42
Filterable PM^2	2.20E-03	0.31	0.01	0.03
Total PM^2	2.20E-03	0.31	0.01	0.03
Total PM_{10}[2]	2.20E-03	0.31	0.01	0.03
Total $PM_{2.5}$[2]	2.20E-03	0.31	0.01	0.03
SO_2	2.05E-03	0.29	0.01	0.03
VOC	2.47E-03	0.35	0.01	0.03
CO_2	1.15	164.0	2.9	15.75
CH_4[3]	4.63E-05	6.61E-03	1.16E-04	6.34E-04
N_2O[3]	9.26E-06	1.32E-03	2.31E-05	1.27E-04
CO_2e[4]	1.15	164.6	2.88	15.81
Hazardous Air Pollutants (HAP)				
Benzene	6.53E-06	9.33E-04	1.63E-05	8.95E-05
Toluene	2.86E-06	4.09E-04	7.16E-06	3.92E-05
Xylenes	2.00E-06	2.85E-04	4.99E-06	2.73E-05
Propylene	1.81E-05	2.58E-03	4.52E-05	2.47E-04
1,3-Butadiene	2.74E-07	3.91E-05	6.84E-07	3.75E-06
Formaldehyde	8.26E-06	1.18E-03	2.07E-05	1.13E-04
Acetaldehyde	5.37E-06	7.67E-04	1.34E-05	7.35E-05
Acrolein	6.48E-07	9.25E-05	1.62E-06	8.87E-06
Naphthalene[5]	5.94E-07	8.48E-05	1.48E-06	8.13E-06
Acenaphthylene[5]	3.54E-08	5.06E-06	8.86E-08	4.85E-07
Acenaphthene[5]	9.94E-09	1.42E-06	2.49E-08	1.36E-07
Fluorene[5]	2.04E-07	2.92E-05	5.11E-07	2.80E-06
Phenanthrene[5]	2.06E-07	2.94E-05	5.15E-07	2.82E-06
Anthracene[5]	1.31E-08	1.87E-06	3.27E-08	1.79E-07
Fluoranthene[5]	5.33E-08	7.61E-06	1.33E-07	7.30E-07
Pyrene[5]	3.35E-08	4.78E-06	8.37E-08	4.58E-07
Benzo(a)anthracene[5]	1.18E-08	1.68E-06	2.94E-08	1.61E-07
Chrysene[5]	2.47E-09	3.53E-07	6.18E-09	3.38E-08
Benzo(b)fluoranthene[5]	6.94E-10	9.91E-08	1.73E-09	9.50E-09
Benzo(k)fluoranthene[5]	1.09E-09	1.55E-07	2.71E-09	1.49E-08
Benzo(a)pyrene[5]	1.32E-09	1.88E-07	3.29E-09	1.80E-08
Indeno(1,2,3-cd)pyrene[5]	2.63E-09	3.75E-07	6.56E-09	3.60E-08
Dibenz(a,h)anthracene[5]	4.08E-09	5.83E-07	1.02E-08	5.59E-08
Benzo(g,h,I)perylene[5]	3.42E-09	4.89E-07	8.56E-09	4.69E-08
Total HAP	-	-	1.13E-04	6.19E-04

Notes:
1. Emission factor per AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Table 3.3-1 and 3.3-2 (10/96).
2. For conservatism, it is assumed filterable PM = total PM = total PM_{10} = total $PM_{2.5}$.
3. Emission factor for CH_4 and N_2O per 40 CFR Part 98, Table C-2 for petroleum fuels.
4. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last amended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

5. Polycyclic Aromatic Hydrocarbons (PAH)

Table 3.1 - Diesel Fire Pump #2 Operating Parameters

Maximum Power Output[1]	Potential Operation	Maximum Heat Input
HP	hr/yr	MMBtu/hr
50	100	0.35

Notes:
1. Estimated HP based on flow required.

Table 3.2 - Diesel Fire Pump #2 Potential Emissions

Pollutant	Emission Factor[1]		Potential Emissions	
	lb/hp-hr	lb/MMBtu	STPY	lbs/day
Pollutants and Greenhouse Gases (GHG)				
CO	6.68E-03	0.95	0.02	0.09
NOx	3.10E-02	4.41	0.08	0.42
Filterable PM^2	2.20E-03	0.31	0.01	0.03
Total PM^2	2.20E-03	0.31	0.01	0.03
Total $PM_{10}{}^2$	2.20E-03	0.31	0.01	0.03
Total $PM_{2.5}{}^2$	2.20E-03	0.31	0.01	0.03
SO_2	2.05E-03	0.29	0.01	0.03
VOC	2.47E-03	0.35	0.01	0.03
CO_2	1.15	164.0	2.9	15.75
$CH_4{}^3$	4.63E-05	6.61E-03	1.16E-04	6.34E-04
N_2O^3	9.26E-06	1.32E-03	2.31E-05	1.27E-04
CO_2e^4	1.15	164.6	2.88	15.81
Hazardous Air Pollutants (HAP)				
Benzene	6.53E-06	9.33E-04	1.63E-05	8.95E-05
Toluene	2.86E-06	4.09E-04	7.16E-06	3.92E-05
Xylenes	2.00E-06	2.85E-04	4.99E-06	2.73E-05
Propylene	1.81E-05	2.58E-03	4.52E-05	2.47E-04
1,3-Butadiene	2.74E-07	3.91E-05	6.84E-07	3.75E-06
Formaldehyde	8.26E-06	1.18E-03	2.07E-05	1.13E-04
Acetaldehyde	5.37E-06	7.67E-04	1.34E-05	7.35E-05
Acrolein	6.48E-07	9.25E-05	1.62E-06	8.87E-06
Naphthalene[5]	5.94E-07	8.48E-05	1.48E-06	8.13E-06
Acenaphthylene[5]	3.54E-08	5.06E-06	8.86E-08	4.85E-07
Acenaphthene[5]	9.94E-09	1.42E-06	2.49E-08	1.36E-07
Fluorene[5]	2.04E-07	2.92E-05	5.11E-07	2.80E-06
Phenanthrene[5]	2.06E-07	2.94E-05	5.15E-07	2.82E-06
Anthracene[5]	1.31E-08	1.87E-06	3.27E-08	1.79E-07
Fluoranthene[5]	5.33E-08	7.61E-06	1.33E-07	7.30E-07
Pyrene[5]	3.35E-08	4.78E-06	8.37E-08	4.58E-07
Benzo(a)anthracene[5]	1.18E-08	1.68E-06	2.94E-08	1.61E-07
Chrysene[5]	2.47E-09	3.53E-07	6.18E-09	3.38E-08
Benzo(b)fluoranthene[5]	6.94E-10	9.91E-08	1.73E-09	9.50E-09
Benzo(k)fluoranthene[5]	1.09E-09	1.55E-07	2.71E-09	1.49E-08
Benzo(a)pyrene[5]	1.32E-09	1.88E-07	3.29E-09	1.80E-08
Indeno(1,2,3-cd)pyrene[5]	2.63E-09	3.75E-07	6.56E-09	3.60E-08
Dibenz(a,h)anthracene[5]	4.08E-09	5.83E-07	1.02E-08	5.59E-08
Benzo(g,h,I)perylene[5]	3.42E-09	4.89E-07	8.56E-09	4.69E-08
Total HAP	-	-	1.13E-04	6.19E-04

Notes:
1. Emission factor per AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Table 3.3-1 and 3.3-2 (10/96).
2. For conservatism, it is assumed filterable PM = total PM = total PM_{10} = total $PM_{2.5}$.
3. Emission factor for CH_4 and N_2O per 40 CFR Part 98, Table C-2 for petroleum fuels.
4. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last amended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

5. Polycyclic Aromatic Hydrocarbons (PAH)

Table 0.1 - Feedstock and Fuel Throughputs

Material	Quantity of Equipment	Hourly Throughput Wet	Annual Throughput Wet		Annual Throughput Dry	Moisture Content	Comments
		MTPH	MTPY	STPY	STPY	%	
Roundwood Received	-	38.0	292,752	322,704	193,622	40	Based on HMB (55/45 split).
Green Residuals Received	-	31.1	239,594	264,108	149,485	43	Based on HMB (55/45 split).
Max Green Hammer Mill Throughput	2	36.0	630,720	695,250	426,188	39	Based on max equipment throughput @ max potential operating hours. Should be verified with vendor (Bruks: Proposal No. 21-010284-HM-R1, 10/20/22).
Max Dry Hammer Mill Throughput	3	14.0	367,920	405,562	365,006	10	Based on max equipment throughput @ max potential operating hours. Should be verified with vendor (Prodesa: Offer No. 2934-OFS-05-0005, 10/28/22).
Max Pellet Mill Throughput	8	4.8	336,384	370,800	337,428	9	Based on max equipment throughput @ max potential operating hours. Should be verified with vendor (Prodesa: Offer No. 2934-OFS-05-0005, 10/28/22).
Finished Pellets Throughput	-	38.9	300,000	330,693	307,545	7	Based on capacity rating of facility.
Fuel Screen Throughput	-	8.0	61,632	67,938	43,616	36	Based on HMB (55/45 split). Purchased fule + bark from debarking drum + woodyard chip screen overs.

Table 0.2 - Particulate Collection Operating Parameters

Equipment	Quantity of Equipment	Air Flow Each	Air Flow Total	Inlet Loading	Assumed Outlet Loading	Comments
		dscfm	dscfm	gr/dscf	gr/dscf	
Green Hammer Mill Air System	2	0	0		0.01	GHMs (Bruks) utilize recirculation instead of collection.
Dry Hammer Mill Cyclone	2	25,000	50,000		0.02	Based on vendor proposal (Prodesa: Offer No. 2934-OFS-05-0005,
Pellet Cooler Baghouses	1	50,000	50,000		0.002	Approximation based on email from vendor (Prodesa, Forcus Martinez,
Pellet Storage - Vent Fan	2	2,702	5,403		0.01	Approximation based on email from vendor (Prodesa, Forcus Martinez,
Pellet Storage - High Temp Fans	6	0	0		0.01	Approximation based on email from vendor (Prodesa, Forcus Martinez,
Rail Loadout Baghouse	1	50,000	50,000		0.002	Air flow from Nexus - 9/1/23 email (Prodesa). Updated based on Nexus

Table 0.3 - Combustion Units Emission Guarantees

Equipment	Quantity of Equipment	Pollutant	Emissions Guarantee Each		Emissions Guarantee Total		Comments
			lb/hr	STPY	lb/hr	STPY	
Dryer/RTO	1	CO	25.0	109.5	25.0	109.5	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22).
Dryer/RTO	1	NOx	29.5	109.5	29.5	109.5	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated annual - 9/8/23 email from Nexus - TSI update.
Dryer/RTO	1	PM	5.2	22.8	5.2	22.8	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22).
Dryer/RTO	1	SO2		0.0	0.0	0.0	
Dryer/RTO	1	VOC	11.3	0.0	11.3	0.0	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated annual - 9/8/23 email from Nexus - TSI update.
Dryer/RTO	1	Total HAP		0.0	0.0	0.0	
Dryer/RTO	1	CO2	100,000.0	438,000.0	100,000.0	438,000.0	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).
Dryer/RTO	1	CH4	3.5	15.3	3.5	15.3	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).
RCO	1	VOC	14.0	33.3	14.0	33.3	Projected emissions based on vendor proposal (TSI: Proposal No. 221118, 11/18/22). Updated annual based on Nexus email 9/15/23.
RCO	1	CO2	3,000.0	13,140.0	3,000.0	13,140.0	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).
RCO	1	CH4	7.5	32.9	7.5	32.9	Projected emissions based on vendor email (TSI: Zo Savovic, 6/21/22).

Table 0.4 - Combustion Units Burner Parameters

Equipment	Quantity of Equipment	Heat Input Each	Heat Input Total	Comments
		MMBtu/hr	MMBtu/hr	
Tar Buildup Control Burner	0	0.0	0.0	Eliminated based on email from vendor (TSI, Zo Savovic, 8/9/22).
RTO Burner System	1	5.1	5.1	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
RTO - Bakeout Operation	1	20.0	20.0	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
RCO Burner System	1	8.3	8.3	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
RCO - Bakeout Operation	1	25.0	25.0	Based on Nexus provided data on July 11, 2024 (from vendor proposal).
Furnaces (Dryer Heat)	1	83.0	83	CEQA Data Request provided to Trinity. Updated per Nexus email 9/13/23.

Table 0.5 - Diesel Fire Pump Operating Parameters

Maximum Power Output	
kW	HP
112	150

Table 1.1 - Facility-Wide Emissions

Emission Source	CO	NOx	Filterable PM	Total PM10	Total PM2.5	SO2	VOC	CO2e	Acetaldehyde	Formaldehyde	Methanol	Total HAP
	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY	STPY
Roundwood Processing												
Truck Unloading	-	-	7.62E-03	3.61E-03	5.46E-04	-	-	-	-	-	-	-
Log Pile	-	-	7.62E-03	3.61E-03	5.46E-04	-	-	-	-	-	-	-
Drum Debarker	-	-	7.62E-03	3.61E-03	5.46E-04	-	-	-	-	-	-	-
Chipper	-	-	7.62E-03	3.61E-03	5.46E-04	-	-	-	-	-	-	-
Green Residuals Processing												
Truck Unloading	-	-	5.57E-03	2.63E-03	3.99E-04	-	-	-	-	-	-	-
Woodyard Chip Screening	-	-	1.24E-02	5.85E-03	8.86E-04	-	-	-	-	-	-	-
Woodyard Fuel Screening	-	-	1.43E-03	6.77E-04	1.03E-04	-	-	-	-	-	-	-
Wood Chip Piles	-	-	1.09E-02	5.17E-03	7.83E-04	-	-	-	-	-	-	-
Green Hammer Mill Screening	-	-	1.09E-02	5.17E-03	7.83E-04	-	-	-	-	-	-	-
Green Hammer Mills	-	-	0	0	0	-	0	-	0	0	0	0
Drying												
Dryer	109.5	54.8	22.8	25.0	25.0	-	26.3	-	1.12	1.42	1.12	5.5
RTO Burners	1.63	2.83	0.04	0.15	0.15	3.26E-03	0.22	2,776	-	5.86E-04	-	1.47E-02
Furnace Abort Operations	2.39	0.88	2.23	1.99	1.71	0.10	0.07	794.41	3.31E-03	1.75E-02	-	1.55E-01
Dry Chips Storage												
Dry Chips Storage	-	-	6.67E-02	3.16E-02	4.78E-03	-	24.3	-	0.20	0.41	0.40	1.00
Pelletizing												
Dry Hammer Mills	-	-	33.0	33.0	33.0	-	25.3	-	0.04	0.08	0.04	0.21
Pellet Mills and Pellet Coolers	-	-	3.3	3.3	3.3	-	4.6	-	9.27E-03	1.85E-02	9.27E-03	0.09
Pellet Storage & Loadout												
Pellet Storage & Loadout	-	-	5.09	5.09	5.09	-	3.3	-	0.01	0.02	0.01	0.03
Balance of Plant												
RCO Burners	2.65	4.59	7.05E-02	0.25	0.25	5.29E-03	3.53E-01	4,505	-	9.51E-04	-	2.39E-02
Diesel Fire Pump	0.10	0.47	3.30E-02	3.30E-02	3.30E-02	3.08E-02	3.71E-02	17.3	8.05E-05	1.24E-04	-	6.78E-04
Facility-Wide Total With Fugitives	113.9	62.6	64.5	66.9	66.9	3.93E-02	84.5	7,298	1.38	1.94	1.57	6.8
Facility-Wide Total Without Fugitives	113.9	62.6	64.4	66.9	66.8	3.93E-02	84.5	7,298	1.38	1.94	1.57	6.8
Title V Major Source Threshold	100	100	100	100	100	100	100	-	10	10	10	25
Above Title V Threshold?	Yes	No	No	No	No	No	No	-	No	No	No	No
NSR Major Source Threshold	250	100	250	250	250	250	100	75,000	-	-	-	-
Above PSD/NA-NSR Threshold?[1]	No	No	No	No	No	No	No	No	-	-	-	-

Notes:

1. A wood pellet production facility is not considered within a stationary source category as listed in 40 CFR Part 70 State Operating Permit Programs. Therefore, fugitives are excluded from PSD Major Source determination.

Table 2.1 - Roundwood Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Truck Unloading	322,704
Log Pile	322,704
Drum Debarker	322,704
Chipper	322,704

Notes:
1. Annual throughput based on amount of roundwood required per finished pellet production design.

Table 2.2 - Raw Material Handling Emission Factors

Pollutant	Emission Factor[1]
	lb/ton
Filterable PM	4.72E-05
Filterable PM_{10}	2.23E-05
Filterable $PM_{2.5}$	3.38E-06

Notes:
1. PM emisson factors for receiving and storage calculated using continuous drop point equation from AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (11/06).

$$E = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:

E = emission factor (lb/ton)

k = particle size mulitiplier (dimensionless)

k (PM)	0.74
k (PM_{15})	0.48
k (PM_{10})	0.35
k (PM_{5})	0.20
k ($PM_{2.5}$)	0.053

U = mean wind speed (mph) 6.2

M = material moisture content (%) 40

Table 2.3 - Potential Emissions from Raw Material Handling

Emission Source	Filterable PM	Filterable PM_{10}	Filterable $PM_{2.5}$
	STPY	STPY	STPY
Truck Unloading	7.62E-03	3.61E-03	5.46E-04
Log Pile	7.62E-03	3.61E-03	5.46E-04
Drum Debarker	7.62E-03	3.61E-03	5.46E-04
Chipper	7.62E-03	3.61E-03	5.46E-04

Table 3.1 - Green Residuals Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Truck Unloading	264,108
Woodyard Chip Screening	586,811
Woodyard Fuel Screening	67,938
Wood Chip Piles	518,874
Green Hammer Mill Screen	518,874

Notes:
1. Annual throughput based on amount of green residuals required per finished pellet production design.

Table 3.2 - Raw Material Handling Emission Factors

Pollutant	Emission Factor[1]
	lb/ton
Filterable PM	4.21E-05
Filterable PM_{10}	1.99E-05
Filterable $PM_{2.5}$	3.02E-06

Notes:
1. PM emisson factors for receiving and storage calculated using continuous drop point equation from AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (11/06).

$$E = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:
E = emission factor (lb/ton)
k = particle size mulitiplier (dimensionless)

k (PM)	0.74
k (PM_{15})	0.48
k (PM_{10})	0.35
k (PM_{5})	0.20
k ($PM_{2.5}$)	0.053

U = mean wind speed (mph) 6.2
M = material moisture content (%) 43

Table 3.3 - Potential Emissions from Raw Material Handling

Emission Source	Filterable PM	Filterable PM_{10}	Filterable $PM_{2.5}$
	STPY	STPY	STPY
Truck Unloading	5.57E-03	2.63E-03	3.99E-04
Woodyard Chip Screening	1.24E-02	5.85E-03	8.86E-04
Woodyard Fuel Screening	1.43E-03	6.77E-04	1.03E-04
Wood Chip Piles	1.09E-02	5.17E-03	7.83E-04
Green Hammer Mill Screen	1.09E-02	5.17E-03	7.83E-04

Table 4.1 - Green Hammermill Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Green Hammer Mills	695,250

Notes:
1. Annual throughput of green residuals processed through the green hammermill, based on max capacity of green hammermill.

Table 4.2 - Green Hammermill Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Green Hammer Mill Air Sys	0	1.00E-02	0	0

Table 4.3 - Green Hammermill Potential VOC and HAP Emissions

Pollutant	Emission Factor	Control Efficiency[4]	Potential Emissions[4]
	lb/ton	%	STPY
VOC*	1.08	100	0
Acetaldehyde[1]	4.00E-03	100	0
Formaldehyde[1]	8.00E-03	100	0
Methanol[1]	4.00E-03	100	0
Acrolein[2]	0	100	0
Phenol[3]	4.50E-03	100	0
Propionaldehyde[2]	0	100	0
Total HAP	-	-	0

Notes:
1. Emission factor per GAEPD recommendation for hammermill at wood pellet manufacturing facility.
2. Emission factor below detectable limit per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
3. Emission factor from AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
4. Emissions are recirculated into the process stream and are not removed from the process. Therefore, no emissions are emitted.

Table 5.1 - Dryer Operating Parameters

Annual Throughput Wet[1]	Potential Operation
ODT/yr	hr/yr
405,562	7,704

Notes:
1. Annual throughput based on maxium dry hammermill throughput. ODT (oven dried ton) is considered to equate to 10% moisture content.

Table 5.2 - Dryer Potential Emissions

Pollutant	Wood Drying Emission Factor[3]	WESP Control Efficiency[4]	RTO Control Efficiency[5]	Potential Emissions[6]
	lb/ODT	%	%	STPY
CO[1]	5.3	0	50	109.5
NOx[1]	2.7	0	50	54.8
Filterable PM[1]	2.2	99	0	22.8
Condensable PM	1.1	99	0	2.2
Total PM_{10}[2]	3.3	99	0	25.0
Total $PM_{2.5}$[2]	3.3	99	0	25.0
VOC[1]	6	0	95	26.3
HAP				
Acetaldehyde	0.11	0	95	1.1
Formaldehyde	0.14	0	95	1.4
Methanol	0.11	0	95	1.1
Acrolein	0.023	0	95	0.2
HCl	0.019	70	0	1.2
Phenol	0.028	0	95	0.3
Propionaldehyde	0.013	0	95	0.1
Total HAP	-	-	-	5.5

Notes:
1. Potential emissions per vendor documentation for the Dryer/RTO system and SNCR (50% controls for NOx).
2. Emission factor is the sum of the filterable PM and condensable PM. For conservatism, it is assumed filterable PM_{10} = filterable $PM_{2.5}$.
3. Emission factor per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility and AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-3 at particleboard manufacturing facility. Filterable PM is conservative as GAEPD considers 2.2 lb/ODT to be total PM while AP-42 Section 10.6.2, Table 10.6.2-1 considers it to only be filterable PM.
4. WESP PM control effiiciency per EPA-452/F-03-029 Air Pollution Control Technology Fact Sheet. WESP HCl control efficiency per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility.
5. RTO control effiiciency per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility.
6. Potential emissions are based on vendor data where available and calculated where not available.

Table 5.3 - Furnace Abort Operation Parameters

Furnaces Heat Input	Potential Operation[1]
MMBtu/hr	hr/yr
83.0	96

Notes:
1. Presumed abort stack use (and combustion emissions not controlled by RTO) for up to 8 hr/month.

Table 5.4 - Furnace Abort Operation Potential Emissions

Pollutant	Wood Combustion Emission Factor[3]	Potential Emissions[6]
	lb/MMBtu	STPY
CO[2]	0.60	2.39
NOx[2]	0.22	0.88
Filterable PM[1]	0.56	2.23
Filterable PM_{10}[1]	0.50	1.99
Filterable $PM_{2.5}$[1]	0.43	1.71
VOC[3]	0.017	0.07
SO2[2]	0.025	0.10
CO2	195	777
N2O	0.013	0.05
CH4	0.021	0.08
CO2e[5]	199.4	794
HAP[3,4]		
1,1,1-Trichloroethane	5.50E-05	2.19E-04
1,2-Dibromoethene	3.10E-05	1.24E-04
2-Chloronaphthalene	2.40E-09	9.56E-09
Acenaphthene	9.10E-07	3.63E-06
Acenaphthylene	5.00E-06	1.99E-05
Acetaldehyde	8.30E-04	3.31E-03
Acrolein	4.00E-03	1.59E-02
Anthracene	3.00E-06	1.20E-05
Antimony	7.90E-06	3.15E-05
Arsenic	2.20E-05	8.76E-05
Benzene	4.20E-03	1.67E-02
Benzo(a)anthracene	6.50E-08	2.59E-07
Benzo(a)pyrene	2.60E-06	1.04E-05
Benzo(b)fluoranthene	1.00E-07	3.98E-07
Benzo(e)pyrene	2.60E-09	1.04E-08

Benzo(g,h,i)perylene	9.30E-08	3.71E-07
Benzo(j,k)fluoranthene	1.60E-07	6.37E-07
Benzo(k)fluoranthene	3.60E-08	1.43E-07
Beryllium	1.10E-06	4.38E-06
Bis(2-ethylhexyl)phthalate	4.70E-08	1.87E-07
Bromomethane	1.50E-05	5.98E-05
Cadmium	4.10E-06	1.63E-05
Carbazole	1.80E-06	7.17E-06
Carbon tetrachloride	4.50E-05	1.79E-04
Chlorine	7.90E-04	3.15E-03
Chlorobenzene	3.30E-05	1.31E-04
Chloroform	2.80E-05	1.12E-04
Chromium	2.10E-05	8.37E-05
Chromium VI	3.50E-06	1.39E-05
Chrysene	3.80E-08	1.51E-07
Cobalt	6.50E-06	2.59E-05
Decachlorobiphenyl	2.70E-10	1.08E-09
Dibenzo(a,h)anthracene	9.10E-09	3.63E-08
Dichlorobiphenyl	7.40E-10	2.95E-09
1,2-Dichloroethane	2.90E-05	1.16E-04
1,2-Dichloropropane	3.30E-05	1.31E-04
2,4-Dinitrophenol	1.80E-07	7.17E-07
Ethylbenzene	3.10E-05	1.24E-04
Fluoranthene	1.60E-06	6.37E-06
Fluorene	3.40E-06	1.35E-05
Formaldehyde	4.40E-03	1.75E-02
Hydrogen Chloride	1.90E-02	7.57E-02
Heptachlorobiphenyl	6.60E-11	2.63E-10
Hexachlorobiphenyl	5.50E-10	2.19E-09
Heptachlorodibenzo-p-dioxins	2.00E-09	7.97E-09
Heptachlorodibenzo-p-furans	2.40E-10	9.56E-10
Hexachlorodibenzo-p-dioxins	1.60E-06	6.37E-06
Hexachlorodibenzo-p-furans	2.80E-10	1.12E-09
Indeno(1,2,3,c,d)pyrene	8.70E-08	3.47E-07
Lead	4.80E-05	1.91E-04
Manganese	1.60E-03	6.37E-03
Mercury	3.50E-06	1.39E-05
Methyl chloride (chloromethane)	2.30E-05	9.16E-05
2-Methylnaphthalene	1.60E-07	6.37E-07
Methylene chloride (dichloromethane)	2.90E-04	1.16E-03
Monochlorobiphenyl	2.20E-10	8.76E-10
Naphthalene	9.70E-05	3.86E-04
Nickel	3.30E-05	1.31E-04
4-Nitrophenol	1.10E-07	4.38E-07
Octachlorodibenzo-p-dioxins	6.60E-08	2.63E-07
Octachlorodibenzo-p-furans	8.80E-11	3.51E-10
Pentachlorodibenzo-p-dioxins	1.50E-09	5.98E-09
Pentachlorodibenzo-p-furans	4.20E-10	1.67E-09
Pentachlorobiphenyl	1.20E-09	4.78E-09

Pentachlorophenol	5.10E-08	2.03E-07
Perylene	5.20E-10	2.07E-09
Phenanthrene	7.00E-06	2.79E-05
Phenol	5.10E-05	2.03E-04
Phosphorus	2.70E-05	1.08E-04
Propionaldehyde	6.10E-05	2.43E-04
Pyrene	3.70E-06	1.47E-05
Selenium	2.80E-06	1.12E-05
Styrene	1.90E-03	7.57E-03
2,3,7,8-Tetrachlorodibenzo-p-dioxins	8.60E-12	3.43E-11
Tetrachlorodibenzo-p-dioxins	4.70E-10	1.87E-09
2,3,7,8-Tetrachlorodibenzo-p-furans	9.00E-11	3.59E-10
Tetrachlorodibenzo-p-furans	7.50E-10	2.99E-09
Tetrachlorobiphenyl	2.50E-09	9.96E-09
Tetrachloroethene	3.80E-05	1.51E-04
Toluene	9.20E-04	3.67E-03
Trichlorobiphenyl	2.60E-09	1.04E-08
Trichloroethylene (trichloroethene)	3.00E-05	1.20E-04
2,4,6-Trichlorophenol	2.20E-08	8.76E-08
Vinyl chloride	1.80E-05	7.17E-05
o-Xylene	2.50E-05	9.96E-05
Total HAPs	-	**1.55E-01**

Notes:

1. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-1 -bark and wet wood (4/22).

2. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-2 -bark and wet wood (4/22).

3. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-3 -bark and wet wood (4/22).

4. Emission factors from AP-42 Section 1.6 Wood Residue Combustion, Table 1.6-4 -bark and wet wood (4/22).

5. CO2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO2	1
CH4	25
N2O	298

Table 7.1 - RTO Operating Parameters - Normal and Bakeout

Heat Input	Propane Heating Value[1]		Potential Operation	Propane Combustion Limit
MMBtu/hr	Btu/gal	Btu/scf	hr/yr	MMscf/yr
5.1	91,500	2,544	7,704	15.4
20.0	91,500	2,544	24	0.2

Notes:
1. Propane heating value per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion.

Table 7.2 - RTO Potential Emissions

Pollutant	Propane Emission Factor[1]		Normal - Potential Emissions[9]	Bakeout - Potential Emissions[9]
	lb/1,000 gal	lb/MMscf	STPY	STPY
Pollutants and Greenhouse Gases (GHG)				
CO	7.5	208.5	1.61	0.02
NOx	13.0	361.4	2.79	0.03
Filterable PM	0.20	5.6	0.04	5.25E-04
Condensable PM	0.50	13.9	0.11	1.31E-03
Total PM[2]	0.70	19.5	0.15	1.84E-03
Total PM_{10}[2]	0.70	19.5	0.15	1.84E-03
Total $PM_{2.5}$[2]	0.70	19.5	0.15	1.84E-03
SO_2[3]	0.1S	0.4	3.22E-03	3.93E-05
VOC[4]	1.0	27.8	0.21	2.62E-03
Lead[4]	-	5.00E-04	3.86E-06	4.72E-08
CO_2	12,500	347,512	2,684	32.79
CH_4	0.20	5.6	0.04	5.25E-04
N_2O	0.90	25.0	0.19	2.36E-03
CO_2e[6]	12,773	355,107	2,742	33.50
Hazardous Air Pollutants (HAP)[4]				
Arsenic Compounds	7.19E-06	2.00E-04	1.54E-06	1.89E-08
Benzene	7.55E-05	2.10E-03	1.62E-05	1.98E-07
Beryllium Compounds	4.32E-07	1.20E-05	9.27E-08	1.13E-09
Cadmium	3.96E-05	1.10E-03	8.50E-06	1.04E-07
Chromium Compounds	5.04E-05	1.40E-03	1.08E-05	1.32E-07
Cobalt Compounds(CoC)	3.02E-06	8.40E-05	6.49E-07	7.93E-09
Formaldehyde	2.70E-03	7.50E-02	5.79E-04	7.08E-06
Hexane	6.47E-02	1.8	1.39E-02	1.70E-04
Manganese	1.37E-05	3.80E-04	2.93E-06	3.59E-08
Mercury	9.35E-06	2.60E-04	2.01E-06	2.45E-08
Naphthalene	2.19E-05	6.10E-04	4.71E-06	5.76E-08
Nickel Compounds	7.55E-05	2.10E-03	1.62E-05	1.98E-07
Selenium Compounds	8.63E-07	2.40E-05	1.85E-07	2.26E-09
Toluene(Methylbenzene)	1.22E-04	3.40E-03	2.63E-05	3.21E-07
2-Methylnaphthalene[7]	8.63E-07	2.40E-05	1.85E-07	2.26E-09
3-Methylchloranthrene[8]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
7,12-Dimethylbenzo(a)anthra	5.76E-07	1.60E-05	1.24E-07	1.51E-09
Acenaphthene[7]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Acenaphthylene[7]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Anthracene[7]	8.63E-08	2.40E-06	1.85E-08	2.26E-10
Benzo(a)anthracene[8]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Benzo(a)pyrene[8]	4.32E-08	1.20E-06	9.27E-09	1.13E-10
Benzo(b)fluoranthene[8]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Benzo(k)fluoranthene)[8]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Benzo(g,h,i)perylene[7]	4.32E-08	1.20E-06	9.27E-09	1.13E-10
Chrysene(Benzo(a)phenanth	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Dibenzo(a,h)anthracene[8]	4.32E-08	1.20E-06	9.27E-09	1.13E-10
Fluoranthene[7]	1.08E-07	3.00E-06	2.32E-08	2.83E-10
Fluorene[7]	1.01E-07	2.80E-06	2.16E-08	2.64E-10
Indeno(1,2,3-cd)pyrene[8]	6.47E-08	1.80E-06	1.39E-08	1.70E-10
Phenanathrene[7]	6.11E-07	1.70E-05	1.31E-07	1.60E-09
Pyrene[7]	1.80E-07	5.00E-06	3.86E-08	4.72E-10
Total HAP	-	-	**1.46E-02**	**1.78E-04**

Notes:
1. Emission factor for propane per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion where available. Where unavailable emission factor for natural gas assumed per AP-42 Section 1.4 Natural Gas Combustion.
2. Emission factor is the sum of the filterable PM and condensable PM. For conservatism, it is assumed total PM = total PM_{10} = total $PM_{2.5}$.
3. SO2 emission factor is 0.10S. S equals the sulfur content expressed in gr/100 scf gas vapor. Assume a sulfur content of 0.15 gr/100 scf.
4. Emission factor for VOC, lead and HAP are not listed in AP-42 Section 1.5 Liquefied Petroleum Gas Combustion. Emission factor assumed is per AP-42 Section 1.4 Natural Gas Combustion.
5. RTO control effiiciency per GAEPD recommendation for rotary dryer, direct wood-fired, processing green softwood at wood pellet manufacturing facility.
6. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

7. Polycyclic Organic Matter (POM)
8. Polycyclic Aromatic Compounds (PAC)
9. Emissions for CO, NOx, Filterable PM, SO2 and VOC are included in the dryer emissions.

Table 8.1 - Dry Material Storage Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Dry Chip Storage	405,562

Notes:
1. Annual throughput based on maxium dry hammermill throughput.

Table 8.2 - Raw Material Handling Emission Factors

Pollutant	Emission Factor[1]
	lb/ton
Filterable PM	3.29E-04
Filterable PM_{10}	1.56E-04
Filterable $PM_{2.5}$	2.36E-05

Notes:
1. PM emisson factors for receiving and storage calculated using continuous drop point equation from AP-42 Section 13.2.4 Aggregate Handling and Storage Piles (11/06).

$$E = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:
E = emission factor (lb/ton)
k = particle size mulitiplier (dimensionless)

k (PM)	0.74
k (PM_{15})	0.48
k (PM_{10})	0.35
k (PM_{5})	0.20
k ($PM_{2.5}$)	0.053
U = mean wind speed (mph)	6.2
M = material moisture content (%)	10

Table 8.3 - Potential Emissions from Raw Material Handling

Emission Source	Filterable PM	Filterable PM_{10}	Filterable $PM_{2.5}$
	STPY	STPY	STPY
Dry Chip Storage	6.67E-02	3.16E-02	4.78E-03

Table 8.4 - Dry Material Storage Potential Emissions

Pollutant	Emission Factor[1]	Potential Emissions
	lb/ton	STPY
VOC	0.12	24.3
Acetaldehyde	1.00E-03	0.20
Formaldehyde	2.00E-03	0.41
Methanol	1.95E-03	0.40
Total HAP	-	1.00

Notes:
1. Emission factor per GAEPD recommendation for storage/handling at wood pellet manufacturing facility.

Table 9.1 - Dry Hammermill Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Dry Hammer Mills	405,562

Notes:
1. Annual throughput based on maxium dry hammermill throughput.

Table 9.2 - Dry Hammermill Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Dry Hammer Mill Air Systems	50,000	2.00E-02	8.6	33.0

Table 9.3 - Dry Hammermill Potential VOC and HAP Emissions

Pollutant	Emission Factor	Control Efficiency[4]	Potential Emissions
	lb/ton	%	STPY
VOC[1]	2.5	95	25.3
Acetaldehyde[1]	4.00E-03	95	0.04
Formaldehyde[1]	8.00E-03	95	0.08
Methanol[1]	4.00E-03	95	0.04
Acrolein[2]	0	95	0.00
Phenol[3]	4.50E-03	95	0.05
Propionaldehyde[2]	0	95	0.00E+00
Total HAP	-	-	0.21

Notes:
1. Emission factor per GAEPD recommendation for hammermill at wood pellet manufacturing facility.
2. Emission factor below detectable limit per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
3. Emission factor from AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-7 for hammermill at particleboard manufacturing facility.
4. Emissions from dry hammermills are routed to an RCO. RCO control efficiency for VOC per vendor documentation. RCO control efficiency for HAP assumed to be same as for VOC.

Table 10.1 - Pelleting System Operating Parameters

Emission Source	Annual Throughput Wet[1]	Pellet Density	Volumetric Throughput
	STPY	lb/ft^3	ft^3/yr
Pellet Mill	370,800	40	18,539,989
Pellet Cooler	370,800	40	18,539,989

Notes:
1. Annual throughput based on maxium pellet mill throughput.

Table 10.2 - Pelleting System Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Pellet Cooler Air System	50,000	2.00E-03	0.9	3.3

Table 10.3 - Pelleting System Potential VOC and HAP Emissions

Pollutant	Emission Factor		Control Efficiency[4]	Potential Emissions
	lb/ton	lb/ft^3	%	STPY
VOC[1]	0.5	-	95	4.6
Acetaldehyde[1]	1.00E-03	-	95	9.27E-03
Formaldehyde[1]	2.00E-03	-	95	1.85E-02
Methanol[1]	1.00E-03	-	95	9.27E-03
Acrolein[2]	-	5.84E-06	95	2.71E-03
Phenol[2]	-	1.07E-04	95	0.05
Propionaldehyde[3]	0	-	95	0.00
Total HAP	-	-	-	0.09

Notes:
1. Emission factor per GAEPD recommendation for pelletizer / pellet cooler at wood pellet manufacturing facility.
2. Emission factor per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-6 for board cooler, UF resin at particleboard manufacturing facility. Emission factor is converted from lb/MSF 3/4 to kg/m^3 per footnote a of Table 10.6.2-6, then converted to lb/ft^3.
3. Emission factor below detectable limit per AP-42 Section 10.6.2 Particleboard Manufacturing, Table 10.6.2-6 for board cooler, UF resin at particleboard manufacturing facility.
4. Emissions from pelleting system are routed to an RCO. RCO control efficiency for VOC per vendor documentation. RCO control efficiency for HAP assumed to be same as for VOC.

Table 11.1 - Pellet Storage Operating Parameters

Emission Source	Annual Throughput Wet[1]
	STPY
Pellet Storage	330,693

Notes:
1. Annual throughput based on finished pellet production capacity.

Table 11.2 - Pellet Storage and Loadout Dust Collector Operating Parameters and Potential PM Emissions

Equipment	Air Flow Total	Assumed Outlet Loading	Potential Filterable PM	
	dscfm	gr/dscf	lb/hr	STPY
Pellet Storage - Vent Fan	5,403	1.00E-02	0.5	1.8
Pellet Storage - High Temp Fans	0	1.00E-02	0.0	0.0
Rail Loadout Baghouse	50,000	2.00E-03	0.9	3.3

Table 11.3 - Pellet Storage Potential VOC and HAP Emissions

Pollutant	Emission Factor	Control Efficiency	Potential Emissions[2]
	lb/ton	%	STPY
VOC[1]	0.4	95	3.3
Acetaldehyde[1]	1.00E-03	95	0.01
Formaldehyde[1]	2.00E-03	95	0.02
Methanol[1]	1.00E-03	95	0.01
Total HAP	-	-	0.03

Notes:
1. Emission factor per GAEPD recommendation for storage/handling at wood pellet manufacturing facility.
2. Emissions are for all pellet storage and handling on site.

Table 12.1 - RCO Operating Parameters - Normal and Bakeout

Heat Input	Propane Heating Value[1]		Potential Operation	Propane Combustion Limit
MMBtu/hr	Btu/gal	Btu/scf	hr/yr	MMscf/yr
8.3	91,500	2,544	7,704	25.1
25.0	91,500	2,544	24	0.2

Notes:
1. Propane heating value per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion.

Table 12.2 - RCO Potential Emissions

Pollutant	Propane Emission Factor[1]		Normal - Potential Emissions[9]	Bakeout - Potential Emissions[9]
	lb/1,000 gal	lb/MMscf	STPY	STPY
Pollutants and Greenhouse Gases (GHG)				
CO	7.5	208.5	2.62	0.02
NOx	13.0	361.4	4.54	0.04
Filterable PM	0.20	5.6	0.07	6.56E-04
Condensable PM	0.50	13.9	0.17	1.64E-03
Total PM[2]	0.70	19.5	0.24	2.30E-03
Total PM_{10}[2]	0.70	19.5	0.24	2.30E-03
Total $PM_{2.5}$[2]	0.70	19.5	0.24	2.30E-03
SO_2[3]	0.1S	0.4	0.01	4.92E-05
VOC[4]	1.0	27.8	0.35	3.28E-03
Lead[4]	-	5.00E-04	6.28E-06	5.90E-08
CO_2	12,500	347,512	4,368	40.98
CH_4	0.20	5.6	0.07	6.56E-04
N_2O	0.90	25.0	0.31	2.95E-03
CO_2e[6]	12,773	355,107	4,463	41.88
Hazardous Air Pollutants (HAP)[4]				
Arsenic Compounds	7.19E-06	2.00E-04	2.51E-06	2.36E-08
Benzene	7.55E-05	2.10E-03	2.64E-05	2.48E-07
Beryllium Compounds	4.32E-07	1.20E-05	1.51E-07	1.42E-09
Cadmium	3.96E-05	1.10E-03	1.38E-05	1.30E-07
Chromium Compounds	5.04E-05	1.40E-03	1.76E-05	1.65E-07
Cobalt Compounds(CoC)	3.02E-06	8.40E-05	1.06E-06	9.91E-09
Formaldehyde	2.70E-03	7.50E-02	9.43E-04	8.85E-06
Hexane	6.47E-02	1.8	2.26E-02	2.12E-04
Manganese	1.37E-05	3.80E-04	4.78E-06	4.48E-08
Mercury	9.35E-06	2.60E-04	3.27E-06	3.07E-08
Naphthalene	2.19E-05	6.10E-04	7.67E-06	7.19E-08
Nickel Compounds	7.55E-05	2.10E-03	2.64E-05	2.48E-07
Selenium Compounds	8.63E-07	2.40E-05	3.02E-07	2.83E-09
Toluene(Methylbenzene)	1.22E-04	3.40E-03	4.27E-05	4.01E-07
2-Methylnaphthalene[7]	8.63E-07	2.40E-05	3.02E-07	2.83E-09
3-Methylchloranthrene[8]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
7,12-Dimethylbenzo(a)anthra	5.76E-07	1.60E-05	2.01E-07	1.89E-09
Acenaphthene[7]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Acenaphthylene[7]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Anthracene[7]	8.63E-08	2.40E-06	3.02E-08	2.83E-10
Benzo(a)anthracene[8]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Benzo(a)pyrene[8]	4.32E-08	1.20E-06	1.51E-08	1.42E-10
Benzo(b)fluoranthene[8]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Benzo(k)fluoranthene)[8]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Benzo(g,h,i)perylene[7]	4.32E-08	1.20E-06	1.51E-08	1.42E-10
Chrysene(Benzo(a)phenanth	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Dibenzo(a,h)anthracene[8]	4.32E-08	1.20E-06	1.51E-08	1.42E-10
Fluoranthene[7]	1.08E-07	3.00E-06	3.77E-08	3.54E-10
Fluorene[7]	1.01E-07	2.80E-06	3.52E-08	3.30E-10
Indeno(1,2,3-cd)pyrene[8]	6.47E-08	1.80E-06	2.26E-08	2.12E-10
Phenanathrene[7]	6.11E-07	1.70E-05	2.14E-07	2.00E-09
Pyrene[7]	1.80E-07	5.00E-06	6.28E-08	5.90E-10
Total HAP	-	-	**2.37E-02**	**2.23E-04**

Notes:
1. Emission factor for propane per AP-42 Section 1.5 Liquefied Petroleum Gas Combustion where available. Where unavailable emission factor for natural gas assumed per AP-42 Section 1.4 Natural Gas Combustion.
2. Emission factor is the sum of the filterable PM and condensable PM. For conservatism, it is assumed total PM = total PM_{10} = total $PM_{2.5}$.
3. SO2 emission factor is 0.10S. S equals the sulfur content expressed in gr/100 scf gas vapor. Assume a sulfur content of 0.15 gr/100 scf.
4. Emission factor for VOC, lead and HAP are not listed in AP-42 Section 1.5 Liquefied Petroleum Gas Combustion. Emission factor assumed is per AP-42 Section 1.4 Natural Gas Combustion.
5. RCO control effiiciency for CO per EPA-452/F-03-021 Air Pollution Control Technology Fact Sheet. RCO control efficiency for VOC per vendor documentation. RCO control efficiency for HAP assumed to be same as for VOC.
6. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

7. Polycyclic Organic Matter (POM)
8. Polycyclic Aromatic Compounds (PAC)

Table 13.1 - Diesel Fire Pump Operating Parameters

Maximum Power Output[1]	Potential Operation	Maximum Heat Input
HP	hr/yr	MMBtu/hr
150	200	1.05

Notes:
1. Estimated HP based on flow required.

Table 13.2 - Diesel Fire Pump Potential Emissions

Pollutant	Emission Factor[1]		Potential Emissions
	lb/hp-hr	lb/MMBtu	STPY
Pollutants and Greenhouse Gases (GHG)			
CO	6.68E-03	0.95	0.10
NOx	3.10E-02	4.41	0.47
Filterable PM^{2}	2.20E-03	0.31	0.03
Total PM^{2}	2.20E-03	0.31	0.03
Total PM_{10}^{2}	2.20E-03	0.31	0.03
Total $PM_{2.5}^{2}$	2.20E-03	0.31	0.03
SO_2	2.05E-03	0.29	0.03
VOC	2.47E-03	0.35	0.04
CO_2	1.15	164.0	17.3
CH_4^{3}	4.63E-05	6.61E-03	0.00
N_2O^{3}	9.26E-06	1.32E-03	0.00
CO_2e^{4}	1.15	164.6	17.31
Hazardous Air Pollutants (HAP)			
Benzene	6.53E-06	9.33E-04	9.80E-05
Toluene	2.86E-06	4.09E-04	4.29E-05
Xylenes	2.00E-06	2.85E-04	2.99E-05
Propylene	1.81E-05	2.58E-03	2.71E-04
1,3-Butadiene	2.74E-07	3.91E-05	4.11E-06
Formaldehyde	8.26E-06	1.18E-03	1.24E-04
Acetaldehyde	5.37E-06	7.67E-04	8.05E-05
Acrolein	6.48E-07	9.25E-05	9.71E-06
Naphthalene[5]	5.94E-07	8.48E-05	8.90E-06
Acenaphthylene[5]	3.54E-08	5.06E-06	5.31E-07
Acenaphthene[5]	9.94E-09	1.42E-06	1.49E-07
Fluorene[5]	2.04E-07	2.92E-05	3.07E-06
Phenanthrene[5]	2.06E-07	2.94E-05	3.09E-06
Anthracene[5]	1.31E-08	1.87E-06	1.96E-07
Fluoranthene[5]	5.33E-08	7.61E-06	7.99E-07
Pyrene[5]	3.35E-08	4.78E-06	5.02E-07
Benzo(a)anthracene[5]	1.18E-08	1.68E-06	1.76E-07
Chrysene[5]	2.47E-09	3.53E-07	3.71E-08
Benzo(b)fluoranthene[5]	6.94E-10	9.91E-08	1.04E-08
Benzo(k)fluoranthene[5]	1.09E-09	1.55E-07	1.63E-08
Benzo(a)pyrene[5]	1.32E-09	1.88E-07	1.97E-08
Indeno(1,2,3-cd)pyrene[5]	2.63E-09	3.75E-07	3.94E-08
Dibenz(a,h)anthracene[5]	4.08E-09	5.83E-07	6.12E-08
Benzo(g,h,I)perylene[5]	3.42E-09	4.89E-07	5.13E-08
Total HAP	-	-	6.78E-04

Notes:
1. Emission factor per AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Table 3.3-1 and 3.3-2 (10/96).
2. For conservatism, it is assumed filterable PM = total PM = total PM_{10} = total $PM_{2.5}$.
3. Emission factor for CH_4 and N_2O per 40 CFR Part 98, Table C-2 for petroleum fuels.
4. CO_2e calculated using Global Warming Potentials (GWPs) from 40 CFR Part 98 Subpart A, Table A-1 last ammended 9/13/2021. GWPs are as follows:

CO_2	1
CH_4	25
N_2O	298

5. Polycyclic Aromatic Hydrocarbons (PAH)

GSNR SJVAPCD Marine Emissions

Marine Emission Estimates

Boat Classification	Phase	Engine	Engine Tier	Fuel	# Engines	Engine Rating (hp)	Engine Rating (kW)	Load Factor	Operation (hr/day)	Operation (days/yr)	Emission Factors VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	Maximum Daily Emissions VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	Annual Emissions VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	CO2E
											(g/kW-hr)									(lb/day)									ton/year									(MT/yr)	
Handymax	Berth-Hoteling	Propulsion	Weighted Avg	0.1%S	1	9,893	7,377	0.00	0.00	58	0.600	15.26	1.4	0.36	0.18	0.17	593	0.012	0.029	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Handymax	Berth-Hoteling	Auxiliary	Weighted Avg	0.1%S	1	701	523	1	24.00	58	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029	11.07	316.53	30.44	11.73	5.23	4.81	19,259.68	0.22	0.80	0.32	9.18	0.88	0.34	0.15	0.14	506.69	0.01	0.02	513.13
Handymax	Berth-Hoteling	Auxiliary Boiler	Weighted Avg	0.1%S	1	228	170	1	24.00	58	0.100	2.00	0.2	0.59	0.20	0.19	962	0.002	0.075	0.90	17.99	1.80	5.28	1.82	1.67	8,652.91	0.02	0.67	0.03	0.52	0.05	0.15	0.05	0.05	227.64	0.00	0.02	232.94
Handymax	Manuevering	Propulsion	Weighted Avg	0.1%S	1	9,893	7,377	0.00	1.70	58	12.708	70.64	13.6	1.19	1.34	1.23	1945	0.254	0.134	1.02	5.69	1.09	0.10	0.11	0.10	156.78	0.02	0.01	0.03	0.17	0.03	0.00	0.00	0.00	4.12	0.00	0.00	4.22
Handymax	Manuevering	Auxiliary	Weighted Avg	0.1%S	1	380	283	1	1.70	58	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029	0.42	12.13	1.17	0.45	0.20	0.18	738.20	0.01	0.03	0.01	0.35	0.03	0.01	0.01	0.01	19.42	0.00	0.00	19.67
Handymax	Manuevering	Auxiliary Boiler	Weighted Avg	0.1%S	1	185	138	1	1.70	58	0.100	2.00	0.2	0.59	0.20	0.19	962	0.002	0.075	0.05	1.03	0.10	0.30	0.10	0.10	497.54	0.00	0.04	0.00	0.03	0.00	0.01	0.00	0.00	13.09	0.00	0.00	13.39
Handymax	Transit-Within Bay	Propulsion	Weighted Avg	0.1%S	1	9,893	7,377	0.00	4.50	58	12.708	70.64	13.6	1.19	1.34	1.23	1945	0.254	0.134	2.71	15.07	2.89	0.25	0.29	0.26	415.01	0.05	0.03	0.08	0.44	0.08	0.01	0.01	0.01	10.92	0.00	0.00	11.18
Handymax	Transit-Within Bay	Auxiliary	Weighted Avg	0.1%S	1	298	222	1	4.50	58	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029	0.88	25.19	2.42	0.93	0.42	0.38	1,532.86	0.02	0.06	0.03	0.73	0.07	0.03	0.01	0.01	40.33	0.00	0.00	40.84
Handymax	Transit-Within Bay	Auxiliary Boiler	Weighted Avg	0.1%S	1	84	63	1	4.50	58	0.100	2.00	0.2	0.59	0.20	0.19	962	0.002	0.075	0.06	1.25	0.13	0.37	0.13	0.12	601.25	0.00	0.05	0.00	0.04	0.00	0.01	0.00	0.00	15.82	0.00	0.00	16.19
Tugboats-Handymax	Berth-Hoteling	Propulsion	Weighted Avg	0.1%S	1	2,005	1,495	0.31	0.00	58	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tugboats-Handymax	Berth-Hoteling	Auxiliary	Weighted Avg	0.1%S	1	184	137	0.43	24.00	58	0.40	8.29	1.10	0.42	0.19	0.17	696.00	0.01	0.03	1.25	25.84	3.43	1.32	0.59	0.54	2,169.38	0.02	0.09	0.04	0.75	0.10	0.04	0.02	0.02	57.07	0.00	0.00	57.80
Tugboats-Handymax	Manuevering	Propulsion	Weighted Avg	0.1%S	1	2,005	1,495	0.31	1.70	58	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029	0.99	18.23	2.87	0.59	0.30	0.28	1,044.92	0.02	0.05	0.03	0.53	0.08	0.02	0.01	0.01	27.49	0.00	0.00	27.90
Tugboats-Handymax	Manuevering	Auxiliary	Weighted Avg	0.1%S	1	184	137	0.43	1.70	58	0.40	8.29	1.10	0.42	0.19	0.17	696.00	0.01	0.03	0.09	1.83	0.24	0.09	0.04	0.04	153.66	0.00	0.01	0.00	0.05	0.01	0.00	0.00	0.00	4.04	0.00	0.00	4.09
Tugboats-Handymax	Transit-Within Bay	Propulsion	Weighted Avg	0.1%S	1	2,005	1,495	0.31	4.50	58	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029	2.63	48.25	7.60	1.57	0.80	0.74	2,765.96	0.06	0.13	0.08	1.40	0.22	0.05	0.02	0.02	72.77	0.00	0.00	73.85
Tugboats-Handymax	Transit-Within Bay	Auxiliary	Weighted Avg	0.1%S	1	184	137	0.43	4.50	58	0.40	8.29	1.10	0.42	0.19	0.17	696.00	0.01	0.03	0.23	4.85	0.64	0.25	0.11	0.10	406.76	0.00	0.02	0.01	0.14	0.02	0.01	0.00	0.00	10.70	0.00	0.00	10.84
Emission Subtotals																				**22.31**	**493.88**	**54.82**	**23.24**	**10.13**	**9.33**	**38,394.90**	**0.45**	**1.99**	**0.65**	**14.32**	**1.59**	**0.67**	**0.29**	**0.27**	**1,010.11**	**0.01**	**0.05**	**1,026.04**

Notes: Data taken from the Port of Stockton 2020 Inventory of Air Emissions.
Distance within SJVAPCD based on route along San Joaquin river.

Marine exhaust emissions were calculated using the following equation:

$$Emissions_{diesel} = \sum EF_i \times Eng_i \times AvgHP \times Load_i \times Activity_i$$

Where:

EF	=	*Emission factor in grams per horse-power hour*
Eng	=	*Number of engines*
AvgHP	=	*Maximum rated average horsepower*
Load	=	*Load factor*
Activity	=	*Hours of operation*
i	=	*Equipment type*

Load Factors

Manuevering		
0.002915452		3 knots
Within Bay		
0.002915452		3 knots
Outside of Bay		
0.364431487		15 knots

handymax top speed is 21 knots

	Main Engine Power	Aux Engine kW		
	kW	Transit	Manuevering	Berthing
Handymax	7377	222	283	523

OGV Transit Distance	nm		
	Manuevering	Within Bay	Outside of Bay
Handymax	5.1	13.5	NA

Emission Factors-Weighted

Marine Propulsion

Engine Type	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
				(g/kW-hr)					
Handymax	0.600	15.26	1.4	0.36	0.18	0.17	593	0.012	0.029
Tugboat	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029
Low load Emission Factors									
Handymax	12.708	70.64454	13.552	1.1946	1.341	1.232	1945.0	0.25416	0.13
Tugboat	12.100134	48.58722	15.99136	1.126686	1.268	1.166	1973.2	0.25416	0.13

Marine Auxiliary

Engine Type	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
				(g/kW-hr)					
Handymax	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029
Tugboat	0.400	8.29	1.1	0.42	0.19	0.17	696	0.008	0.029

Marine Propulsion

Engine Type	Engine Family	Model	Tier	Fuel	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
									(g/kW-hr)				
Slow Speed Diesel		<=1999	Tier 0	0.1%S	0.600	17.00	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2000-2010	Tier 1	0.1%S	0.600	16.00	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2011-2015	Tier 2	0.1%S	0.600	14.40	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2016+	Tier 3	0.1%S	0.600	3.40	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel			Tier 4	0.1%S	0.190	1.80	5.0	0.07	0.04	0.04	716	0.012	0.029

Marine Auxiliary

Engine Type	Model	Tier	Fuel	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
								(g/kW-hr)				
Aux Med Speed Diesel	<=1999	Tier 0	0.1%S	0.400	13.8	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2000-2010	Tier 1	0.1%S	0.400	12.2	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2011-2015	Tier 2	0.1%S	0.400	10.5	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2011-2015	Tier 3	0.1%S	0.400	2.6	1.1	0.424	0.19	0.17	696	0.008	0.029
Boiler	NA	NA	0.1%S	0.100	2	0.2	0.587	0.20	0.19	962	0.002	0.075

Ocean Going Vessel Engine Tier Distribution

Year	Tier 0	Tier I	Tier II	Tier III	Tier 4
2020	5.0%	45.5%	49.5%	0.0%	0.0%

Harbor Craft Vessel Engine Tier Distribution

Year	Tier 0	Tier I	Tier II	Tier III	Tier 4
2020	36.0%	0.0%	21.0%	36.0%	7.0%

GSNR BAAQMD Marine Emissions

Marine Emission Estimates

Boat Classification	Phase	Engine	Engine Tier	Fuel	# Engines	Engine Rating (hp)	Engine Rating (kW)	Load Factor	Operation (hr/day)	Operation (days/yr)	Emission Factors (g/kW-hr) VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	Maximum Daily Emissions (lb/day) VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	Annual Emissions ton/year VOC	NOx	CO	SOx	PM10	PM2.5	Annual Emissions (MT/yr) CO2	CH4	N20	CO2E
Handymax	Transit-Within Bay	Propulsion	Weighted Avg	0.1%S	1	9,893	7,377	0.00	21.23	58	12.708	70.64	13.6	1.19	1.34	1.23	1945	0.254	0.134	12.79	71.12	13.64	1.20	1.35	1.24	1,958.21	0.26	0.14	0.37	2.06	0.40	0.03	0.04	0.04	51.52	0.01	0.00	52.75
Handymax	Transit-Within Bay	Auxiliary	Weighted Avg	0.1%S	1	298	222	1	21.23	58	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029	4.16	118.87	11.43	4.41	1.96	1.81	7,232.81	0.08	0.30	0.12	3.45	0.33	0.13	0.06	0.05	190.28	0.00	0.01	192.70
Handymax	Transit-Within Bay	Auxiliary Boiler	Weighted Avg	0.1%S	1	84	63	1	21.23	58	0.100	2.00	0.2	0.59	0.20	0.19	962	0.002	0.075	0.29	5.90	0.59	1.73	0.60	0.55	2,837.01	0.01	0.22	0.01	0.17	0.02	0.05	0.02	0.02	74.64	0.00	0.01	76.38
Handymax	Transit-Outside of Bay	Propulsion	Weighted Avg	0.1%S	1	9,893	7,377	0.36	1.52	58	0.600	15.26	1.4	0.36	0.18	0.17	593	0.012	0.029	5.41	137.46	12.61	3.26	1.66	1.52	5,342.21	0.11	0.26	0.16	3.99	0.37	0.09	0.05	0.04	140.54	0.00	0.01	142.66
Handymax	Transit-Outside of Bay	Auxiliary	Weighted Avg	0.1%S	1	298	222	1	1.52	58	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029	0.30	8.51	0.82	0.32	0.14	0.13	517.77	0.01	0.02	0.01	0.25	0.02	0.01	0.00	0.00	13.62	0.00	0.00	13.79
Handymax	Transit-Outside of Bay	Auxiliary Boiler	Weighted Avg	0.1%S	1	84	63	1	1.52	58	0.100	2.00	0.2	0.59	0.20	0.19	962	0.002	0.075	0.02	0.42	0.04	0.12	0.04	0.04	203.09	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	5.34	0.00	0.00	5.47
Tugboats-Handymax	Transit-Within Bay	Propulsion	Weighted Avg	0.1%S	1	2,005	1,495	0.31	21.23	58	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029	12.39	227.66	35.84	7.41	3.77	3.47	13,051.21	0.26	0.63	0.36	6.60	1.04	0.21	0.11	0.10	343.36	0.01	0.02	348.46
Tugboats-Handymax	Transit-Within Bay	Auxiliary	Weighted Avg	0.1%S	1	184	137	0.43	21.23	58	0.40	8.29	1.10	0.42	0.19	0.17	696.00	0.01	0.03	1.10	22.86	3.03	1.17	0.52	0.48	1,919.30	0.02	0.08	0.03	0.66	0.09	0.03	0.02	0.01	50.49	0.00	0.00	51.14
Emission Subtotals																				**36.47**	**592.80**	**78.01**	**19.62**	**10.05**	**9.24**	**33,061.61**	**0.74**	**1.67**	**1.06**	**17.19**	**2.26**	**0.57**	**0.29**	**0.27**	**869.80**	**0.02**	**0.04**	**883.34**

Notes: Data taken from the Port of Stockton 2020 Inventory of Air Emissions.
Distance within SJVAPCD based on route along San Joaquin river.

Marine exhaust emissions were calculated using the following equation:

$$Emissions_{diesel} = \sum EF_i \times Eng_i \times AvgHP \times Load_i \times Activity_i$$

Where:

EF	=	*Emission factor in grams per horse-power hour*
Eng	=	*Number of engines*
AvgHP	=	*Maximum rated average horsepower*
Load	=	*Load factor*
Activity	=	*Hours of operation*
i	=	*Equipment type*

Load Factors

Manuevering		
0.002915452		3 knots
Within Bay		
0.002915452		3 knots
Outside of Bay		
0.364431487		15 knots

handymax top speed is 21 knots

	Main Engine Power	Aux Engine kW		
	kW	Transit	Manuevering	Berthing
Handymax	7377	222	283	523

OGV Transit Distance nm

	Manuevering	Within Bay	Outside of Bay
Handymax	NA	63.7	22.8

Emission Factors-Weighted

Marine Propulsion

Engine Type	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
				(g/kW-hr)					
Handymax	0.600	15.26	1.4	0.36	0.18	0.17	593	0.012	0.029
Tugboat	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029
Low load Emission Factors									
Handymax	12.708	70.64454	13.552	1.1946	1.341	1.232	1945.0	0.25416	0.13
Tugboat	12.100134	48.58722	15.99136	1.126686	1.268	1.166	1973.2	0.25416	0.13

Marine Auxiliary

Engine Type	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
				(g/kW-hr)					
Handymax	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029
Tugboat	0.400	8.29	1.1	0.42	0.19	0.17	696	0.008	0.029

Marine Propulsion

Engine Type	Engine Family	Model	Tier	Fuel	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
									(g/kW-hr)				
Slow Speed Diesel		<=1999	Tier 0	0.1%S	0.600	17.00	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2000-2010	Tier 1	0.1%S	0.600	16.00	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2011-2015	Tier 2	0.1%S	0.600	14.40	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2016+	Tier 3	0.1%S	0.600	3.40	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel			Tier 4	0.1%S	0.190	1.80	5.0	0.07	0.04	0.04	716	0.012	0.029

Marine Auxiliary

Engine Type	Model	Tier	Fuel	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
								(g/kW-hr)				
Aux Med Speed Diesel	<=1999	Tier 0	0.1%S	0.400	13.8	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2000-2010	Tier 1	0.1%S	0.400	12.2	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2011-2015	Tier 2	0.1%S	0.400	10.5	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2011-2015	Tier 3	0.1%S	0.400	2.6	1.1	0.424	0.19	0.17	696	0.008	0.029
Boiler	NA	NA	0.1%S	0.100	2	0.2	0.587	0.20	0.19	962	0.002	0.075

Ocean Going Vessel Engine Tier Distribution

Year	Tier 0	Tier I	Tier II	Tier III	Tier 4
2020	5.0%	45.5%	49.5%	0.0%	0.0%

Harbor Craft Vessel Engine Tier Distribution

Year	Tier 0	Tier I	Tier II	Tier III	Tier 4
2020	36.0%	0.0%	21.0%	36.0%	7.0%

GSNR Beyond CEQA Marine Emissions

Marine Emission Estimates

Boat Classification	Phase	Engine	Engine Tier	Fuel	Ships	# Engines	Engine Rating (hp)	Engine Rating (kW)	Load Factor	Operation (hr/day)	Operation (days/yr)	Emission Factors VOC (g/kW-hr)	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	Maximum Daily Emissions VOC (lb/day)	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N20	Annual Emissions VOC (ton/year)	NOx	CO	SOx	PM10	PM2.5	CO2 (MT/Yr)	CH4	N20	CO2E
Handymax	Transit-Outside of Bay	Propulsion	Weighted Avg	0.1%S	29	1	9,893	7,377	0.36	24.00	46	12.708	70.64	13.6	1.19	1.34	1.23	1945	0.254	0.134	52,421.46	291,414.04	55,903.02	4,927.81	5,533.21	5,082.13	8,023,436.27	1,048.43	553.87	1,205.69	6,702.52	1,285.77	113.34	127.26	116.89	167,411.19	21.88	11.56	171,401.99
Handymax	Transit-Outside of Bay	Auxiliary	Weighted Avg	0.1%S	29	1	298	222	1	24.00	46	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029	136.25	3,896.35	374.70	144.43	64.38	59.27	237,081.90	2.73	9.88	3.13	89.62	8.62	3.32	1.48	1.36	4,946.78	0.06	0.21	5,009.62
Handymax	Transit-Outside of Bay	Auxiliary Boiler	Weighted Avg	0.1%S	29	1	84	63	1	24.00	46	0.100	2.00	0.2	0.59	0.20	0.19	962	0.002	0.075	9.67	193.33	19.33	56.74	19.53	17.98	92,993.33	0.19	7.25	0.22	4.45	0.44	1.31	0.45	0.41	1,940.33	0.00	0.15	1,985.51
Emission Subtotals																					**52,567.38**	**295,503.73**	**56,297.05**	**5,128.99**	**5,617.12**	**5,159.38**	**8,353,511.51**	**1,051.35**	**571.00**	**1,209.05**	**6,796.59**	**1,294.83**	**117.97**	**129.19**	**118.67**	**174,298.31**	**21.94**	**11.91**	**178,397.13**

Notes: Data taken from the Port of Stockton 2020 Inventory of Air Emissions.
Assumes 29 ships per year traveling to Immingham, UK.

Marine exhaust emissions were calculated using the following equation:

$$Emissions_{diesel} = \sum EF_i \times Eng_i \times AvgHP \times Load_i \times Activity_i$$

Where:

EF	=	*Emission factor in grams per horse-power hour*
Eng	=	*Number of engines*
AvgHP	=	*Maximum rated average horsepower*
Load	=	*Load factor*
Activity	=	*Hours of operation*
i	=	*Equipment type*

Load Factors

Manuevering		
0.002915452		3 knots
Within Bay		
0.002915452		3 knots
Outside of Bay		
0.364431487		15 knots

handymax top speed is 21 knots

	Main Engine Power	Aux Engine kW		
	kW	Transit	Manuevering	Berthing
Handymax	7377	222	283	523

OGV Transit Distance	nm		
	Manuevering	Within Bay	Outside of Bay
Handymax	5.1	13.5	8228

Emission Factors-Weighted

Marine Propulsion

Engine Type	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
	(g/kW-hr)								
Handymax	0.600	15.26	1.4	0.36	0.18	0.17	593	0.012	0.029
Tugboat	0.571	10.49	1.7	0.34	0.17	0.16	602	0.012	0.029
Low load Emission Factors									
Handymax	12.708	70.64454	13.552	1.1946	1.341	1.232	1945.0	0.25416	0.13
Tugboat	12.100134	48.58722	15.99136	1.126686	1.268	1.166	1973.2	0.25416	0.13

Marine Auxiliary

Engine Type	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
	(g/kW-hr)								
Handymax	0.400	11.44	1.1	0.42	0.19	0.17	696	0.008	0.029
Tugboat	0.400	8.29	1.1	0.42	0.19	0.17	696	0.008	0.029

Marine Propulsion

Engine Type	Engine Family	Model	Tier	Fuel	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
					(g/kW-hr)								
Slow Speed Diesel		<=1999	Tier 0	0.1%S	0.600	17.00	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2000-2010	Tier 1	0.1%S	0.600	16.00	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2011-2015	Tier 2	0.1%S	0.600	14.40	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel		2016+	Tier 3	0.1%S	0.600	3.40	1.4	0.36	0.18	0.17	593	0.012	0.029
Slow Speed Diesel			Tier 4	0.1%S	0.190	1.80	5.0	0.07	0.04	0.04	716	0.012	0.029

Marine Auxiliary

Engine Type	Model	Tier	Fuel	VOC	NOx	CO	SOx	PM10	PM2.5	CO2	CH4	N2O
				(g/kW-hr)								
Aux Med Speed Diesel	<=1999	Tier 0	0.1%S	0.400	13.8	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2000-2010	Tier 1	0.1%S	0.400	12.2	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2011-2015	Tier 2	0.1%S	0.400	10.5	1.1	0.424	0.19	0.17	696	0.008	0.029
Aux Med Speed Diesel	2011-2015	Tier 3	0.1%S	0.400	2.6	1.1	0.424	0.19	0.17	696	0.008	0.029
Boiler	NA	NA	0.1%S	0.100	2	0.2	0.587	0.20	0.19	962	0.002	0.075

Ocean Going Vessel Engine Tier Distribution

Year	Tier 0	Tier I	Tier II	Tier III	Tier 4
2020	5.0%	45.5%	49.5%	0.0%	0.0%

Harbor Craft Vessel Engine Tier Distribution

Year	Tier 0	Tier I	Tier II	Tier III	Tier 4
2020	36.0%	0.0%	21.0%	36.0%	7.0%

PM Emissions from Marine Vessel Loading

Emission Factors

PM_{10}	1.17E-04
$PM_{2.5}$	1.78E-05

Note: Based on EPA AP-42 Section 13.2.4.

		Source
k_{PM10}	0.35	AP42 Section 13.2.4.
$K_{PM2.5}$	0.053	AP42 Section 13.2.4.
U	3.4	CalEEMod
M	7	Project description.

Throughput	1000000	MT/yr
	1102310	tons/yr
	11,666.67	MT/day
	12,860.28	tons/day

Emissions

	lb/day	ton/year
PM_{10}	1.51	0.06
$PM_{2.5}$	0.23	0.01

Road Surface Haul Analysis

Lassen & Keystone Sites with Revised Feedstock Boundaries

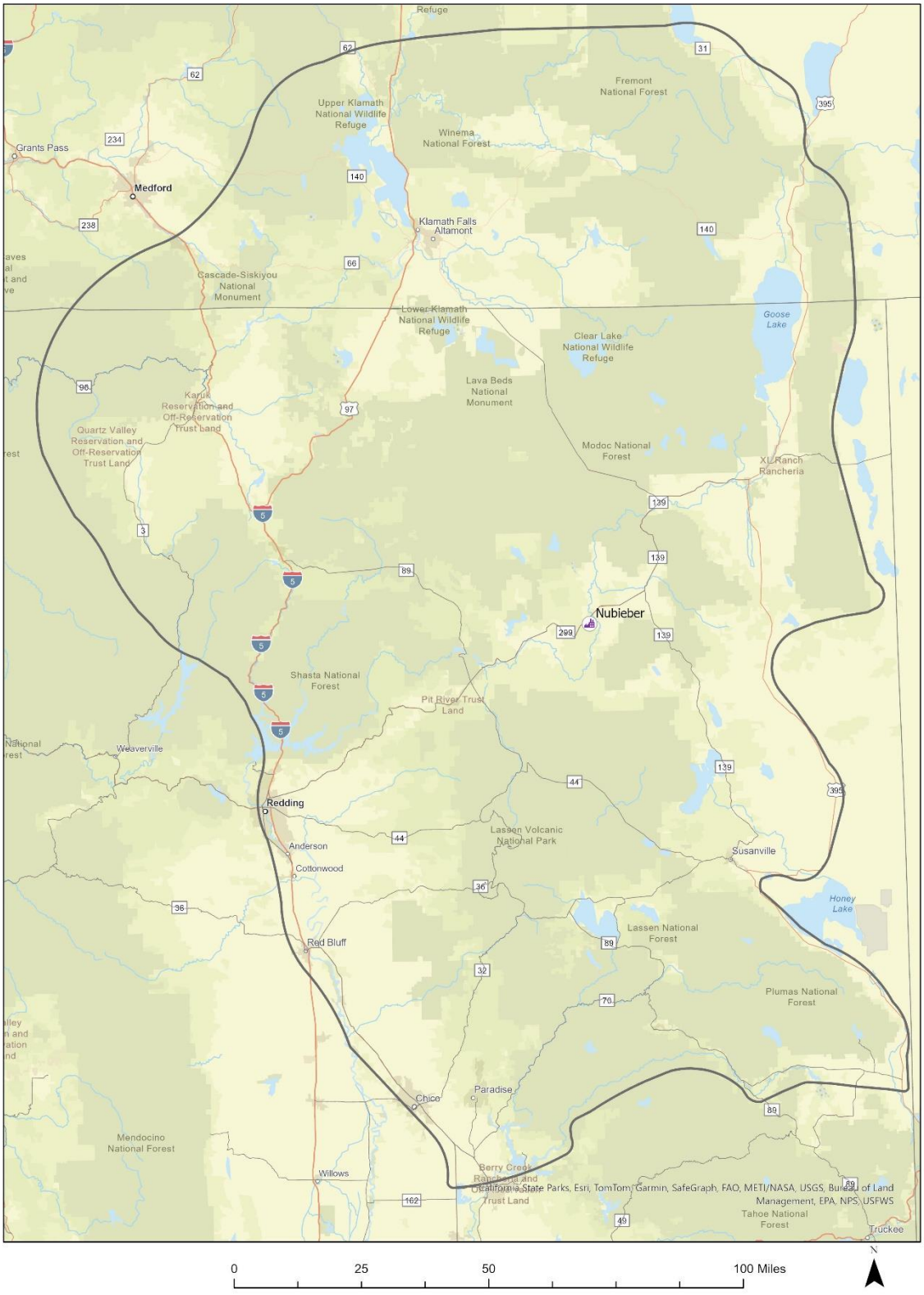
Jim Schmidt

1/25/2024

An analysis of road surfaces on haul routes used to transport biomass material to potential processing facilities at Lassen (Nubieber) and Keystone.

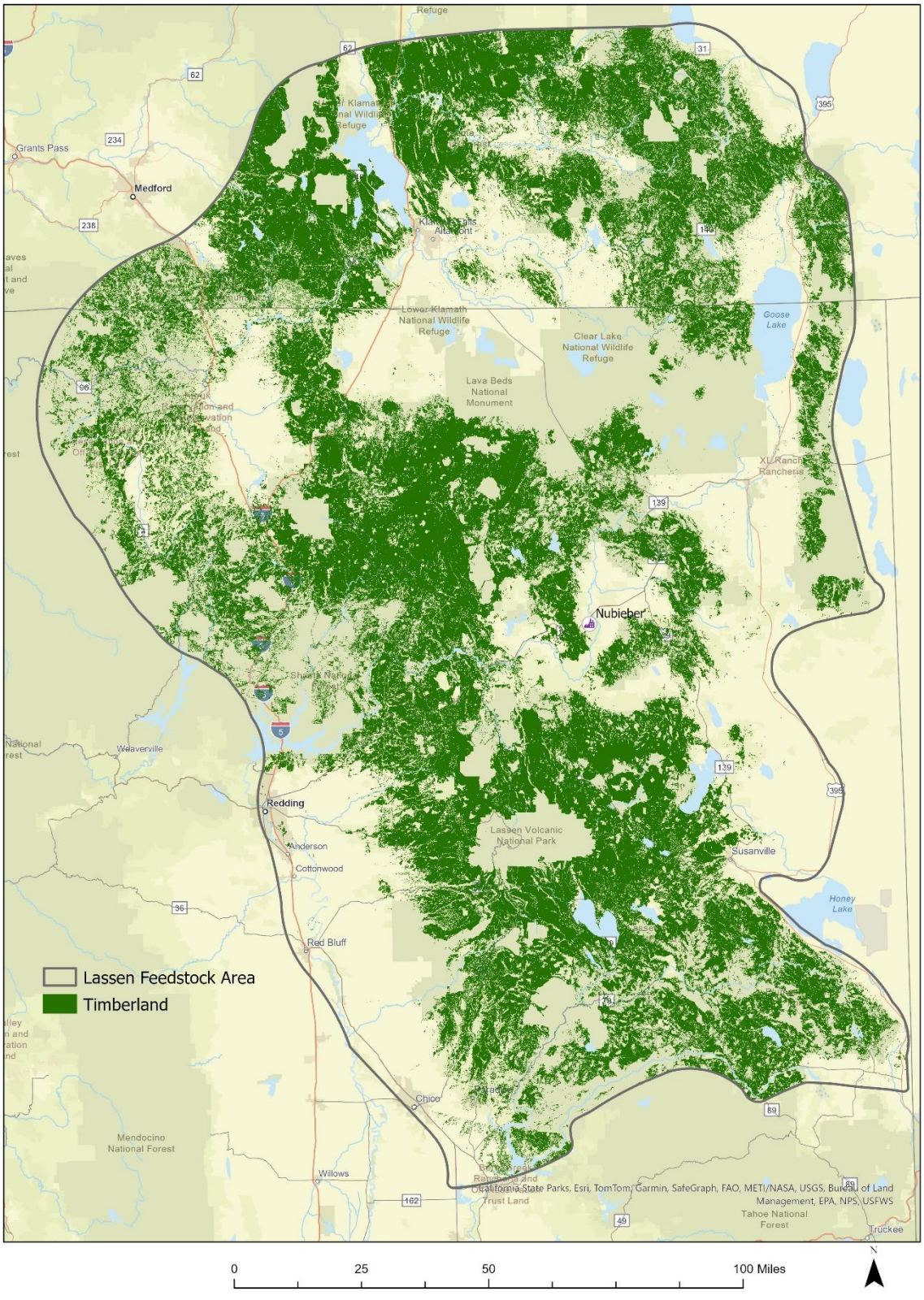
1. Revised Lassen Feedstock Area. The following map displays the extent of the revised Lassen feedstock area along with the location of the proposed Nubieber facility.

Lassen Feedstock Area

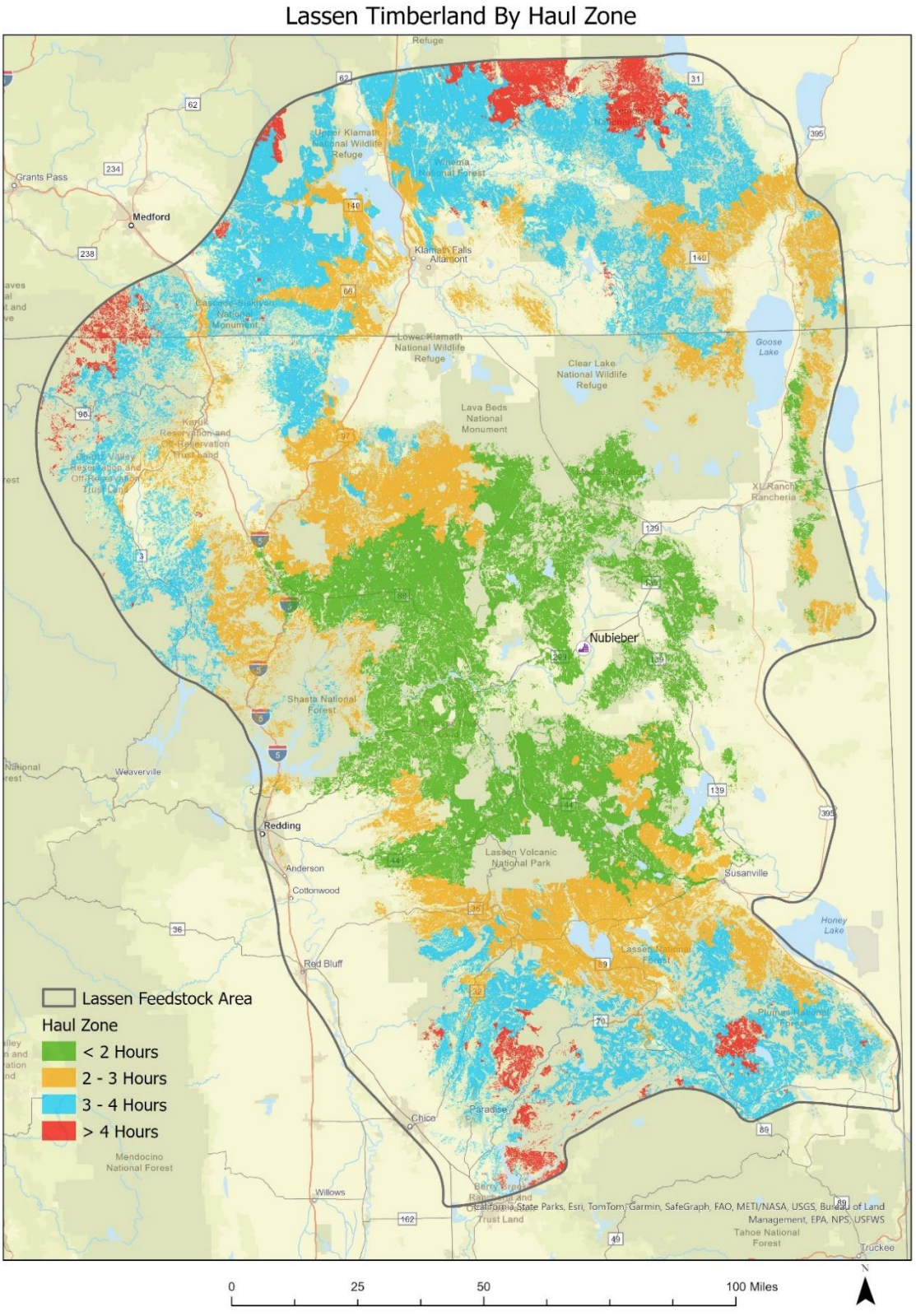


2. Lassen Timberland. The Lassen Timberland map shown on the following page identifies the timberland within the revised Lassen feedstock area. Sources for this map include National Forest vegetation strata maps, state-wide vegetation maps for California from CALFIRE's Forest and Resource Assessment Program and nationwide vegetation maps from the US Forest Service LANDFIRE program. The timberland shown is estimated to be about 6,250,000 acres. Estimated timberland excludes National Parks, Wilderness Areas, Roadless Areas, areas beyond ½ mile from roads, areas over 40% slope and selected fires through the year 2020.

Lassen Timberland

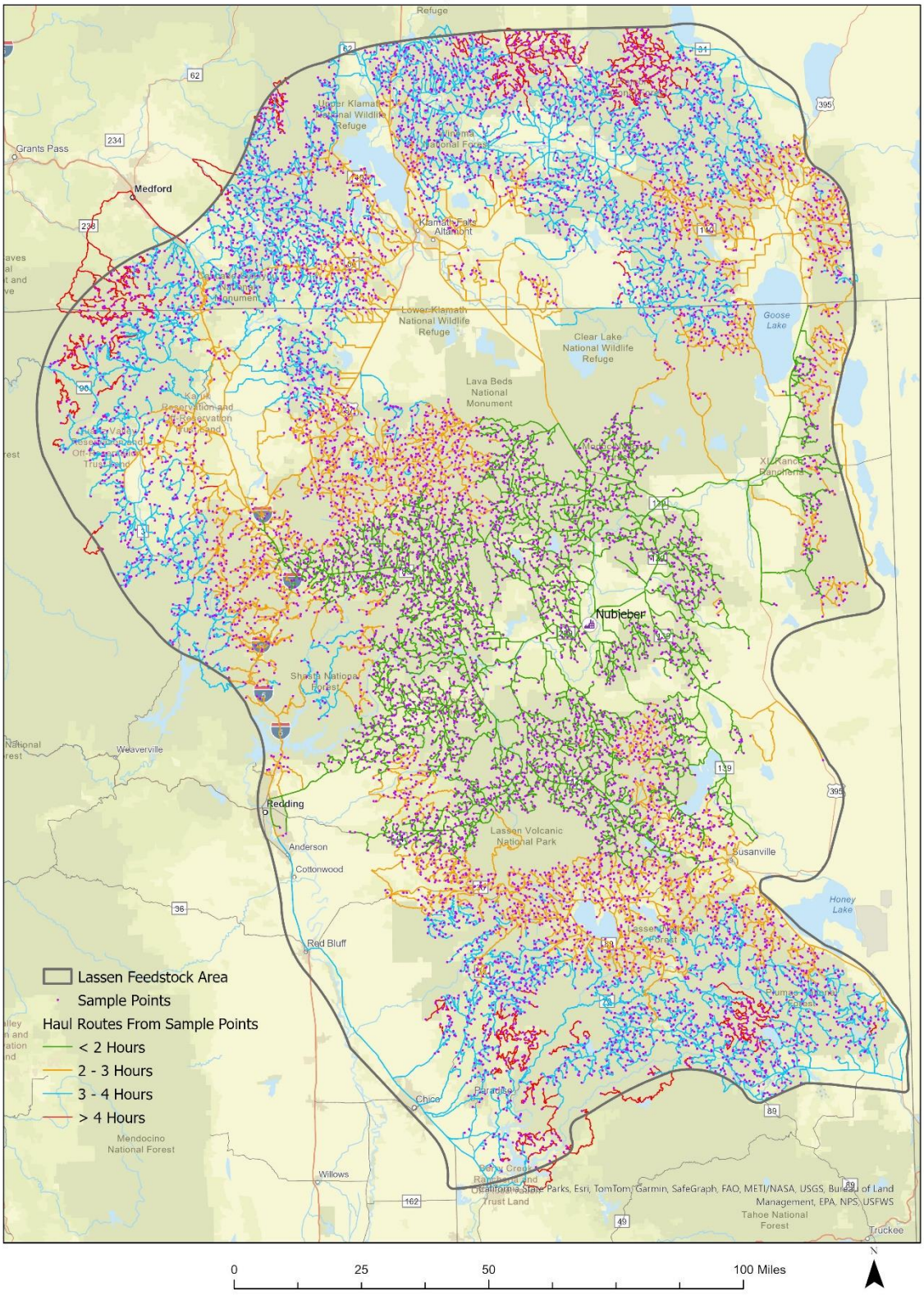


3. Lassen Timberland by Haul Zone: The following map displays timberland by haul zones for the Nubieber facility. Haul zones have been updated to reflect revisions to the feedstock area.

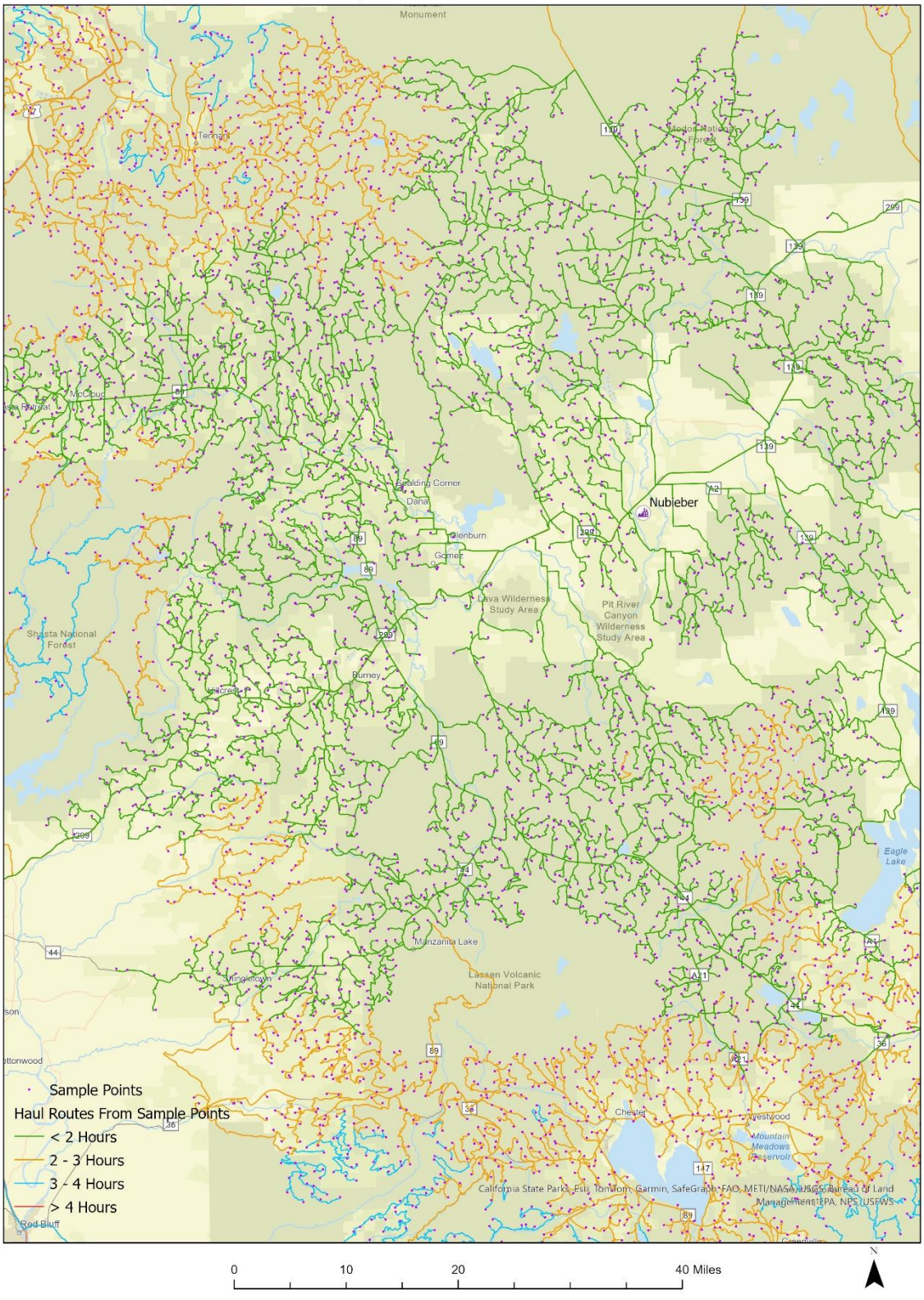


4. Lassen Haul Routes from Sample Locations: Sample origin points for haul trips to the Nubieber facility were created using the ESRI ArcPro software tool to spatially distribute points. The number of sample points was set at 10,000 (one point for every 625 acres of timberland) in order to reach a density of at least 1 point per square mile of timberland. For each sample point, the least-cost route (in terms of time) to the Nubieber facility was determined. The chosen routes along with the sample points are shown in the following two maps. The first map shows the entire feedstock area while the second zooms in to the area around the Nubieber facility.

Lassen Sample Haul Routes

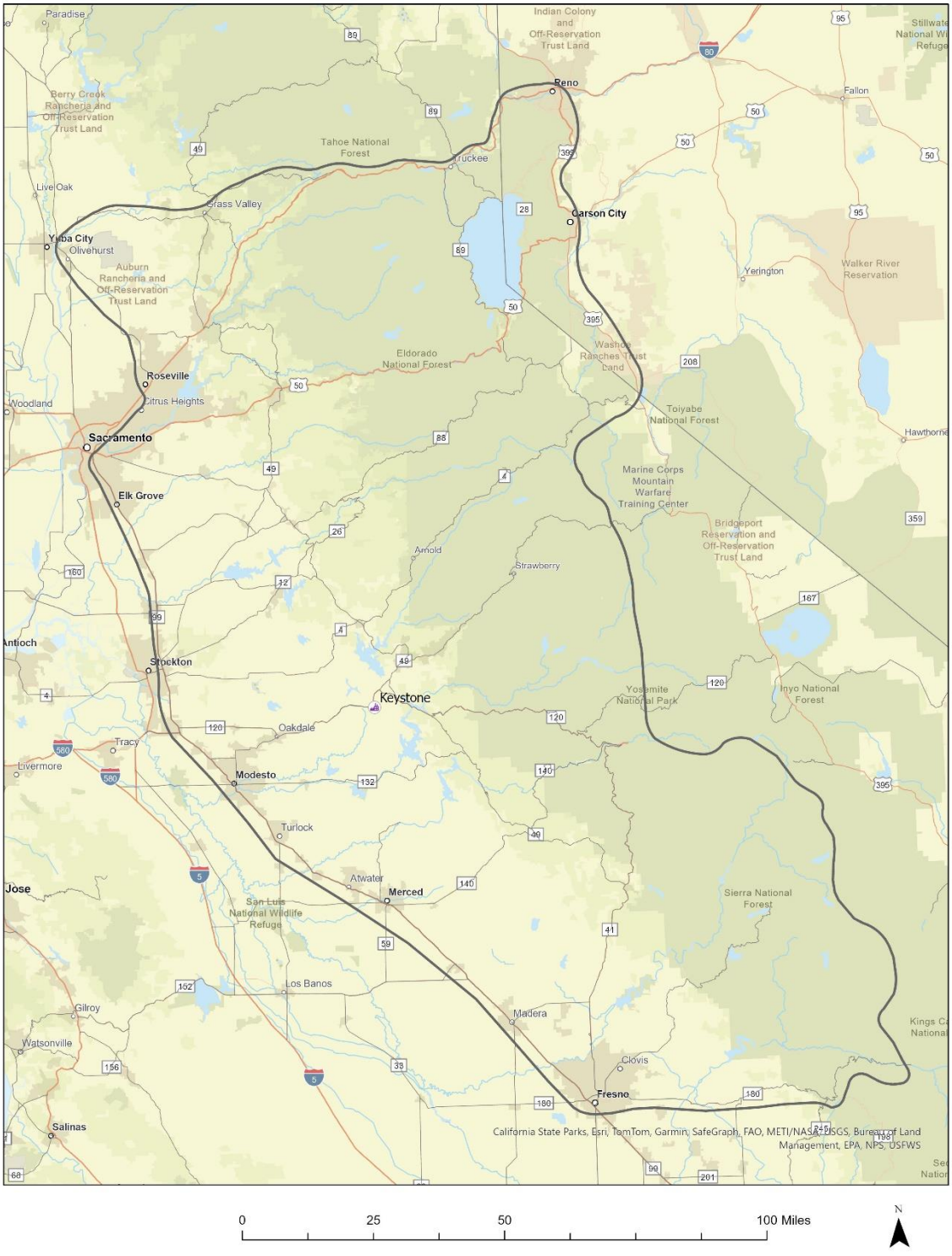


Lassen Sample Haul Routes - Detailed View



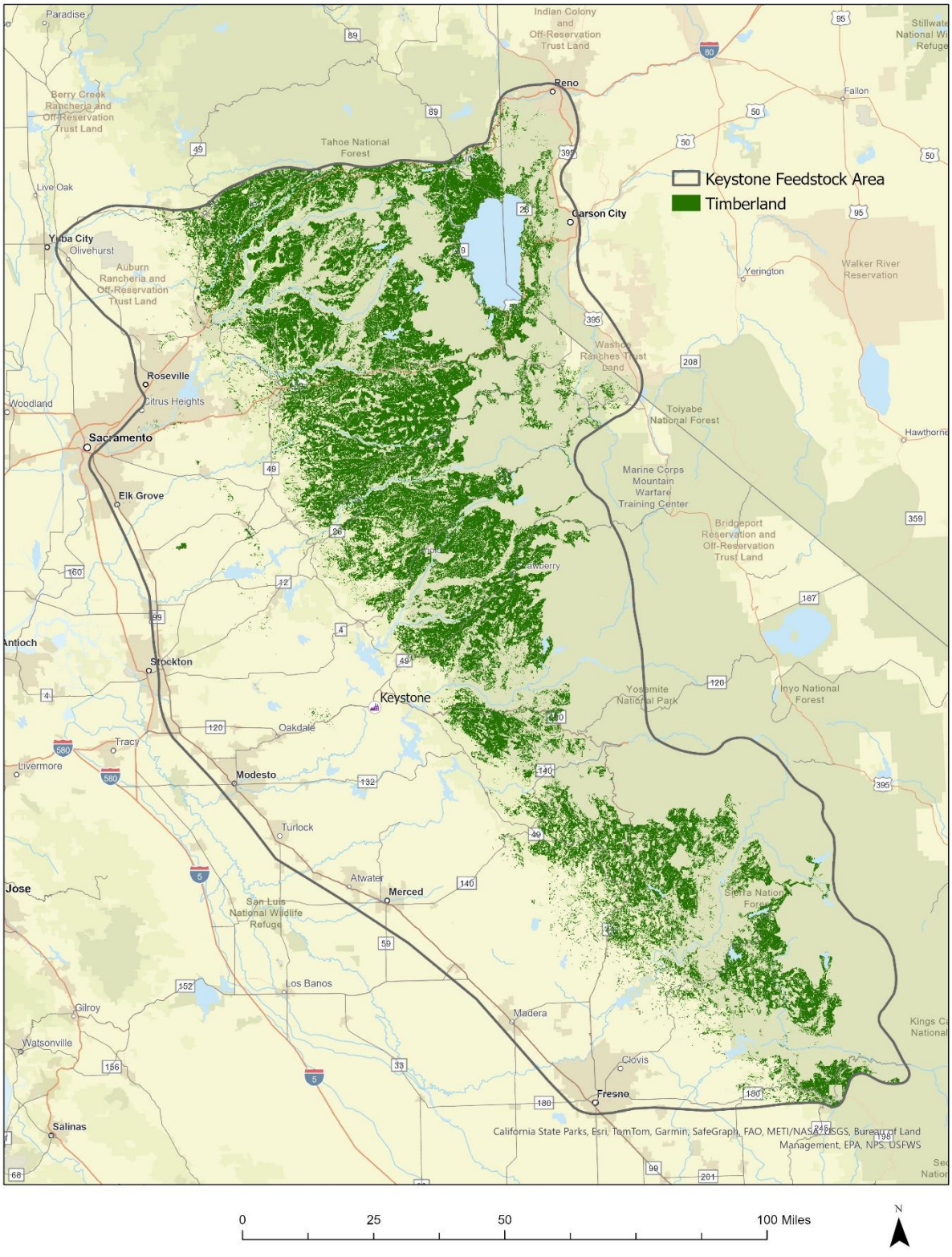
5. Revised Keystone Feedstock Area. The following map displays the extent of the revised Keystone feedstock area along with the location of the proposed facility at Keystone.

Keystone Feedstock Area



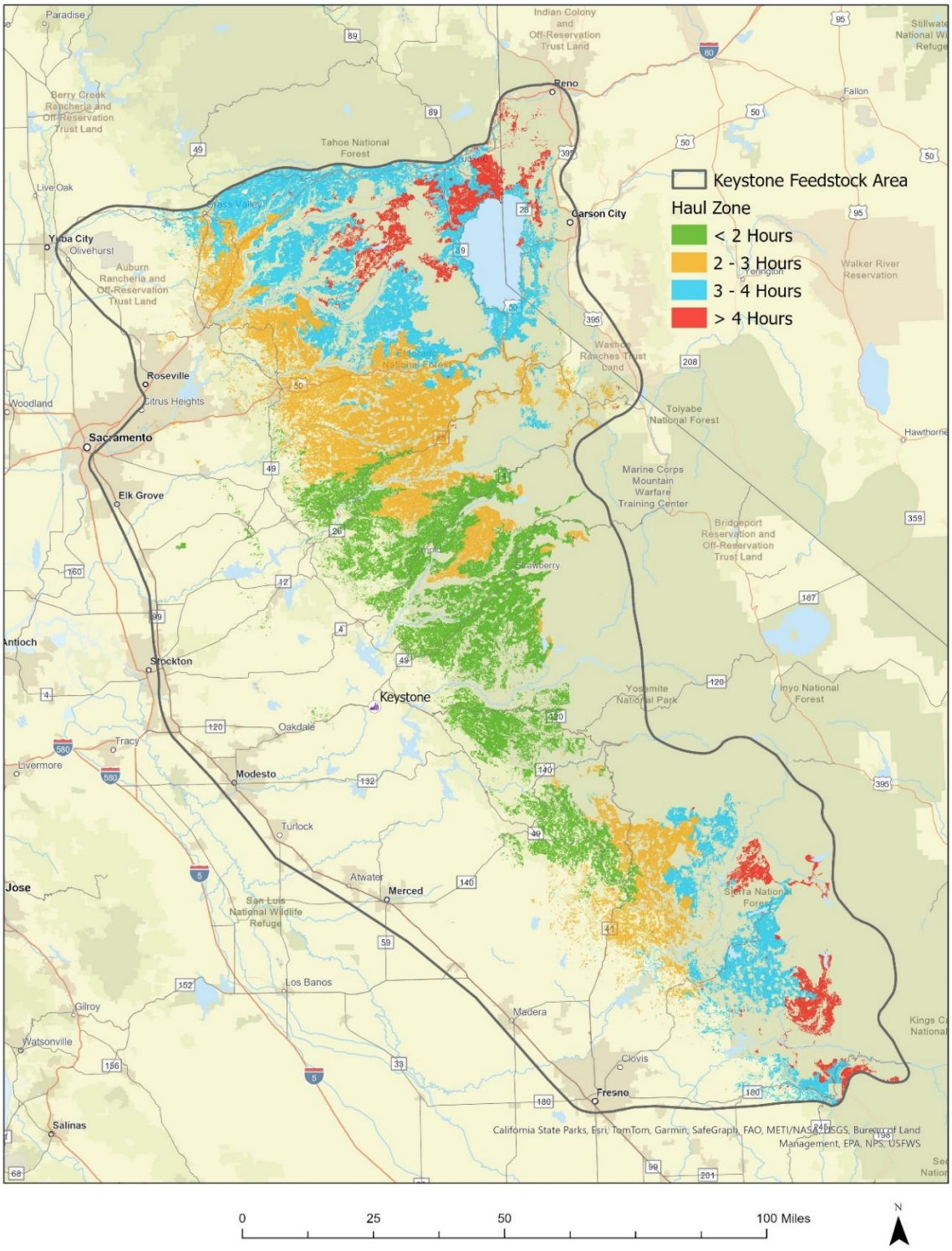
6. Keystone Timberland. The Keystone Timberland map shown on the following page identifies the timberland within the Keystone revised feedstock area. Sources for this map include National Forest vegetation strata maps, state-wide vegetation maps for California from CALFIRE's Forest and Resource Assessment Program. The timberland shown is estimated to be about 2,000,000 acres. Estimated timberland excludes National Parks, Wilderness Areas, Roadless Areas, areas beyond ½ mile from roads, areas over 40% slope and selected large fires through the year 2020.

Keystone Timberland



7. Keystone Timberland by Haul Zone: The following map displays timberland by haul zones for the Keystone facility. Haul zones have been updated to reflect revisions to the feedstock area.

Keystone Timberland By Haul Zone



8. Keystone Haul Routes from Sample Locations: Sample origin points for haul trips to the Keystone facility were created using the ESRI ArcPro software tool to spatially distribute points. The number of sample points was set at 3,500 (one point for every 572 acres of timberland) in order to reach a density of at least 1 point per square mile of timberland. For each sample point, the least cost route (in terms of time) to the Keystone facility was determined. The chosen routes along with the sample points are shown in the following two maps. The first map shows the entire feedstock area while the second zooms in to the area around the Keystone facility.

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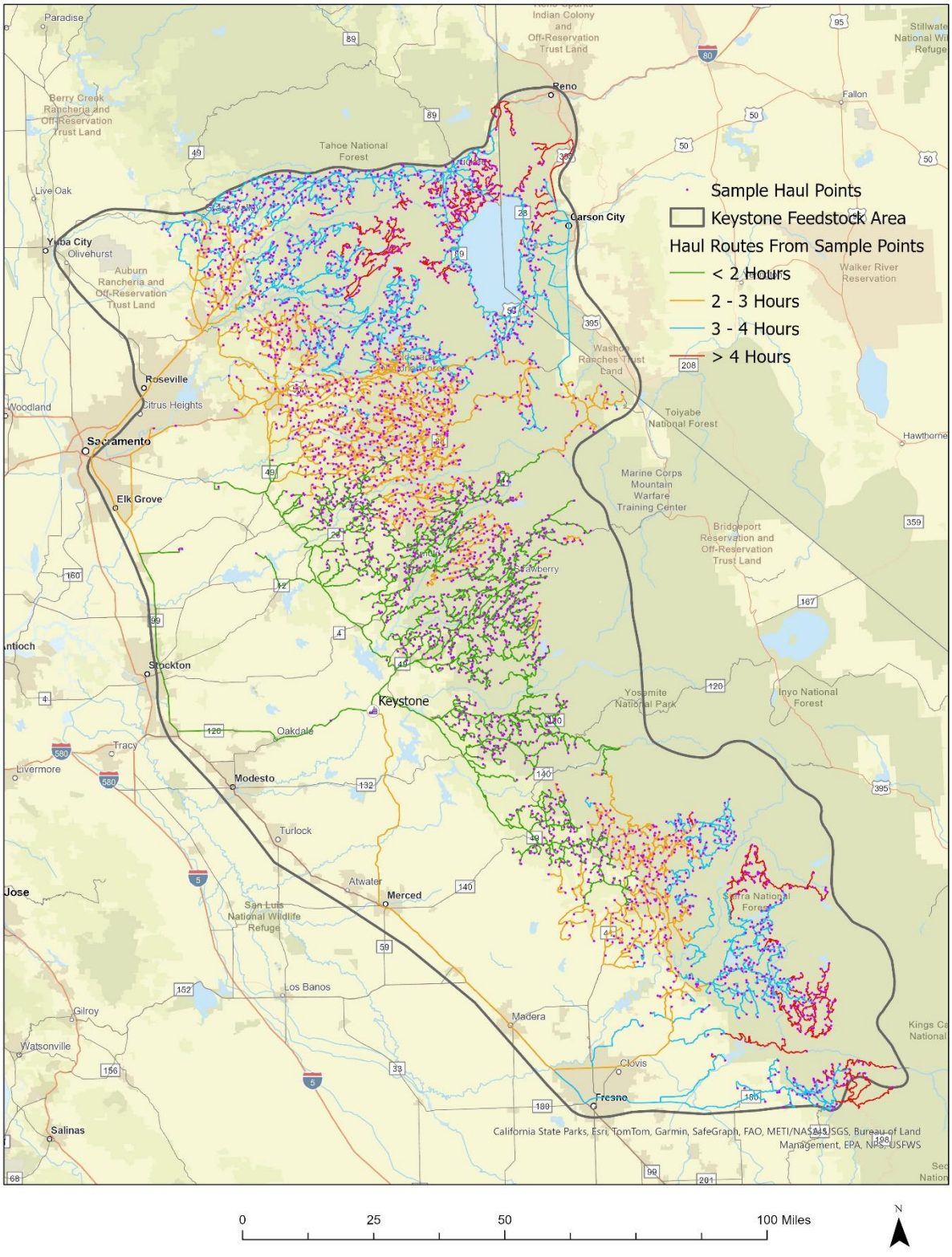
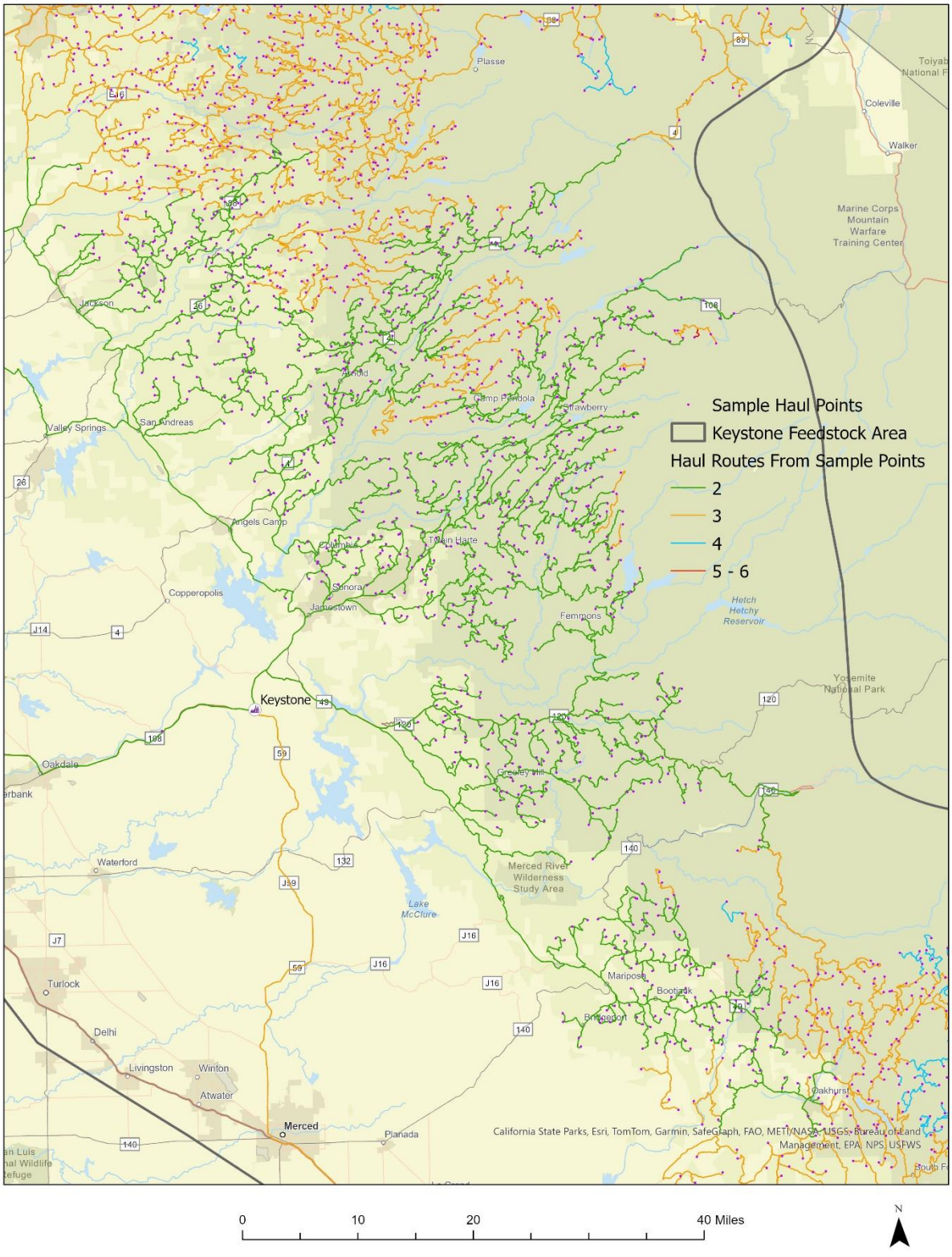
Keystone Sample Haul Routes



Keystone Sample Haul Routes - Detailed View



9. Analysis Results, Lassen and Keystone: The following table displays the results of the haul – surface type analysis.

For the Lassen feedstock area, the sampled haul routes averaged 109 miles for all sample points. On average, 11.3 of those miles (10.4%) were on unpaved roads and 97.7 miles (89.6%) were on paved roads. The percentage of the route on paved roads tended to increase as the haul distance increased. For sample haul routes within a 2-hour haul distance, the percentage on paved roads was estimated to be 85.2%. For haul routes of 4 hours or more, the percentage on paved roads increased to 90.1%.

For the Keystone area, sample haul routes averaged 111.4 miles. On average, 6.6 of those miles (5.9%) were on unpaved roads and 104.8 miles (94.1%) were on paved roads. In the Keystone area, the percentage on paved roads increased from 90.4% in the 2-hour haul zone to 94.8% in the 4-hour+ haul zone.

LASSEN (Nubieber)										
Haul Zone	Estimated Timberland (acres)	Timberland (proportion)	Sample Haul Points (number)	Timberland per Sample Haul Point (acres)	Total Haul Distance for Sample Trips (miles)	Haul Distance Per Sample Trip (miles)	Unpaved Roads on Sample Trips (proportion)	Paved Roads on Sample Trips (proportion)	Unpaved Roads Per Sample Trip (miles)	Paved Roads Per Sample Trip (miles)
< 2 Hours	1,835,823	29.4%	2,938	624.9	158,899.6	54.1	0.148	0.852	8.0	46.1
2 - 3 Hours	1,823,021	29.2%	2,879	633.2	304,512.0	105.8	0.103	0.897	10.8	94.9
3 - 4 Hours	2,226,609	35.6%	3,563	624.9	516,682.7	145.0	0.093	0.907	13.4	131.6
> 4 Hours	364,165	5.8%	620	587.4	109,662.6	176.9	0.099	0.901	17.6	159.3
Total	**6,249,617**	**100.0%**	**10,000**	**625.0**	**1,089,756.9**	**109.0**	**0.104**	**0.896**	**11.3**	**97.7**

KEYSTONE										
Haul Zone	Estimated Timberland (acres)	Timberland (proportion)	Sample Haul Points (number)	Timberland per Sample Haul Point (acres)	Total Haul Distance for Sample Trips (miles)	Haul Distance Per Sample Trip (miles)	Unpaved Roads on Sample Trips (proportion)	Paved Roads on Sample Trips (proportion)	Unpaved Roads Per Sample Trip (miles)	Paved Roads Per Sample Trip (miles)
< 2 Hours	579,166	28.9%	987	586.8	50,876.2	51.5	0.096	0.904	4.9	46.6
2 - 3 Hours	660,574	33.0%	1,142	578.4	114,459.2	100.2	0.062	0.938	6.2	94.0
3 - 4 Hours	588,311	29.4%	1,040	565.7	163,269.4	157.0	0.049	0.951	7.6	149.4
> 4 Hours	173,590	8.7%	331	524.4	61,322.9	185.3	0.052	0.948	9.6	175.6
Total	**2,001,642**	**100.0%**	**3,500**	**571.9**	**389,928**	**111.4**	**0.059**	**0.941**	**6.6**	**104.8**

10. Sources and Methods: Road datasets for the Lassen and Keystone feedstock areas were compiled from three sources: a national USFS dataset of Forest Service System Roads (**Road Core**), a road dataset from the USFS digital topo maps (**FSTOPO**), and a road dataset from **OpenStreetMaps**. Within National Forest boundaries, a combination of the Road Core, FSTOPO, and Opensteetmap roads was used. For areas outside the National Forest, OpenStreetmap was the primary source of road data. The road datasets extend out beyond the feedstock areas to include all roads that might feasibly be used for haul purposes.

Haul times were estimated by assigning road speeds to the roads in the blended road network and using a cost-distance algorithm to calculate the quickest route to Keystone for any point on the map. Road speed assumptions and surface type for the FSTOPO roads and USFS roads were based on the CFF (Cartographic Feature File) symbol assigned to each road as follows:

Speed Assumptions for FSTOPO Roads and USFS Roads

CFF	Surface	CFF Description	MPH
100	paved	ROAD, CLASS 1 (4 or more lanes).	60
101	paved	ROAD, CLASS 1 (2-3 lanes).	50
102	paved	ROAD, CLASS 2 (4 or more lanes).	40
103	paved	ROAD, CLASS 2 (2-3 lanes).	35
139	paved	TUNNEL, ROAD.	30
145	paved	OVERPASS\UNDERPASS	30
517	paved	ROAD, CLASS 3 (1 lane solid).	25
518	unpaved	ROAD, CLASS 3 (1 lane)	20
105	unpaved	ROAD, CLASS 3 (1 lane solid).	15
92	unpaved	ROAD-LIGHT DUTY, Approximate Location	15
93	unpaved	ROAD-LIGHT DUTY, Approximate Location	15
106	unpaved	ROAD, CLASS 4 (1 lane dashed).	10
94	unpaved	ROAD-LIGHT DUTY, Approximate Location	10
95	unpaved	ROAD-LIGHT DUTY, Approximate Location	10
515	unpaved	ROAD-LIGHT DUTY	10
96	unpaved	UNIMPROVED ROAD, Approximate Location	5

For the roads derived from the Openstreetmap source, road speeds were based on the maximum speed assigned to each road segment in the Openstreetmap database, but reduced by 5 mph to account for the slower speed of haul vehicles. If the calculated road speed was less than zero, a road speed of 1 mph was used. If no maximum speed was recorded for a road segment, road speeds were assigned based on the road type (functional class) as follows:

Default Speeds Assigned to OpenStreetMap Roads

Functional class	**MPH**
motorway	60
trunk	50
primary	40
secondary	30
tertiary	20
unclassified	10
track-grade1-5	10
living_street	5
service	5
unknown	5
residential	15

Surface types for Openstreetmap Roads were assigned based on road speeds. All roads with speeds of 25 mph or greater were assumed to be paved roads. Roads with a speed of less than 25 mph were assumed to be unpaved. Where roads from the three data sources overlapped, the highest assumed speed among the overlapping roads was used.

A cost-distance analysis at a 30-meter cell resolution was used to determine the least-cost route in terms of haul time for each of the sample points (10,000 points in the Lassen feedstock area and 3,500 points in the Keystone feedstock area). For each of the sample points, the least-cost route to the mill site was evaluated to determine the mix of paved and unpaved roads used.