Bioeconomy Development Opportunity Zone Rating Lesser Slave Region, AB
Date of Issue: May 30, 2024
BDO Zone Rating: **'BBB'**

BBB
Good Quality

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Wood chips	25,000 odt/yr	$100-$130/odt	150-km drive distance from Kinuso, AB
Bark	20,000 odt/yr	$30-$40/odt	
Forest residues	110,000 odt/yr	$70-$120/odt	

BDO Zone Assets

- **155,000 odt/yr of wood fibre available from existing harvesting and milling operations.**
- **Regional forest industry exhibits strong historical performance.**
- **Lack of competitors within 200 km of Kinuso and 125 km of Mitsue Industrial Park.**
- **Long-term prospects for wood supply from dedicated thinning operations for wildfire prevention.**

BDO Zone Liabilities

- **Forest operations in many areas are restricted to a six-month season, complicating forest residue supply logistics.**
- **Lack of pre-existing forest residue supply chain experience and equipment.**
- **Pulp and pellet facilities in region have demonstrated ability to procure feedstock from over 300 km.**
- **Comparatively high costs of electricity, labour, and land.**

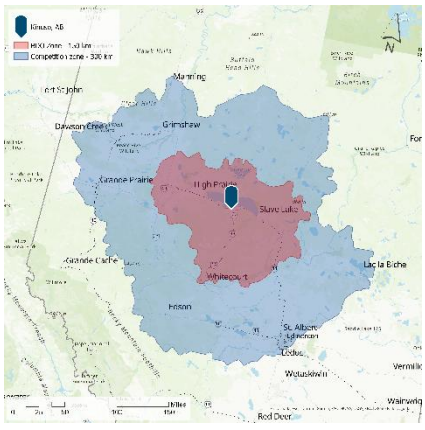
Rating Grade

The Lesser Slave Region, Bioeconomy Development Opportunity Zone is rated 'BBB,' or 'low-moderate' risk.

Risk Rating Grades are defined as follows: AAA (*extremely low*), AA (*very low*), A (*low*), BBB (*low-moderate*), BB (*moderate*), B (*moderate-high*), and C (*high*).

'BBB' ratings indicate good prospective viability of Feedstock Supply and Infrastructure (FS&I), and expectations of FS&I risk are currently low in the Zone. Capacity to support new biobased plant operations is considered adequate, but adverse weather, supply chain, economic, or infrastructure conditions are more likely to impair this capacity over time.

Lesser Slave Region, AB BDO Zone



Scoring & Rating Methodology

In assessing the biomass supply chain risk for the Bioeconomy Development Opportunity (BDO) Zone, 88 Risk Indicators from the Canadian Standards for Biomass Supply Chain Risk (BSCR) were applied. These BDO Zone Risk Indicators are the subset of BSCR Risk Indicators applicable to evaluating feedstock risk within a BDO Zone.

Feedstock quantities are expressed in oven-dry tonnes per year (odt/yr) while feedstock costs are expressed in Canadian dollars (CAD). Maximum transport distance is based on a 150 km driving distance from the center point (Kinuso, AB).

The BDO Zone rating is based on an aggregation of the scores assigned to each BDO Zone Risk Indicator (RI) assessed in this report. First, each BDO Zone Risk Indicator is given a **Raw Risk Likelihood (RRL)** score, which denotes the likelihood of a risk to future BDO Zone projects due to the Risk Indicator. RRL Scores are scaled as either *very low* (2), *low* (4), *medium* (6), *high* (8), or *very high* (10).

Each BDO Zone Risk Indicator is given a **Raw Risk Impact (RRI)** score, which denotes the impact on a future BDO Zone project due to the Risk Indicator. RRI scores are scaled as either *very low* (2), *low*

(4), *medium* (6), *high* (8), or *very high* (10). Impact level scores are based on the impact level of a risk on the successful development and deployment of a BDO Zone project, with no mitigation measures.

The **Gross Risk Indicator (GRI)** score is calculated as the product of the RRL and the RRI scores. For example, if the 'Competitor Price and Price Sensitivity' is scored at a RRL of 2 and a RRI of 8, then the GRI for this risk indicator is $2 \times 8 = 16$.

If the analyst deems that a typical bio-based project could put in place economically reasonable measures or best practices that mitigate either the likelihood (RRL) or the impact (RRI), or both, then the GRI will be notched accordingly.

The **Loaded RI** score for each Risk Indicator is the product of the GRI score and any notched scores. Loaded RIs are the final score for a Risk Indicator.

Loaded RI scores of 4 or less are deemed *very low risk*; scores between 5 and 16 are deemed *low risk*; scores between 17 and 36 are deemed *medium risk*; scores between 37 and 64 are deemed *high risk*; and scores of 65 and greater are deemed *very high risk*.

The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Location is ***24.31 out of 100, resulting in a 'BBB' designation***.

All scoring and rationale for each Risk Indicator are provided in Appendix B.

Analyst Notes

The Lesser Slave Region BDO Zone encompasses a ~25,000 square kilometre area in central Alberta, 300 km north of Edmonton. The BDO Zone occupies a transition area between the Rocky Mountain foothills and the lower boreal forest. High-elevation areas are occupied by lodgepole pine-dominant upland forests, transitional areas are characterized by aspen, balsam poplar, and spruce species, and low-elevation areas are typically black spruce-dominant peatlands.

The forest industry in the broader region includes over 12 sawmills. Two of the 12 sawmills are likely to supply a new project located near the center point of the BDO Zone (Kinuso, AB). With the exception of a sawmill-integrated pellet line, potential competitors to a new project are located on the periphery of the BDO Zone.

Forest residue is the most abundant feedstock type available for new projects. We estimate that approximately 300,000 odt of forest residue accumulates at the roadside annually as a result of harvesting activity on public timberlands within the BDO Zone. Approximately 1/3 of this amount (100,000 odt/yr) is expected to be available at low risk for new projects. A further 10,000 odt/yr could be available from private timberlands within the BDO Zone. Recovering this quantity to market would require modest workforce and equipment investments.

An additional 45,000 odt/yr of sawmill residues (<30% of the total amount) is also likely available for new projects located in the vicinity of Kinuso-Slave Lake. This includes 25,000 odt/yr of wood chips and 20,000 odt/yr of bark, available for new biomass projects for prices of $100-$130/odt and $30-$40/odt, respectively. Note that the entire rated quantity of sawmill residue is available from two sawmills located near the center point of the BDO Zone.

Fibre supply opportunities could also become available over the long term through dedicated wildfire prevention/commercial thinning operations. In recent years, wildfires have burned over 250,000 ha within the BDO Zone. It is possible that the costs associated with wildfire prevention activities (i.e., physical removal of fuel from forests) could be justified by the avoided costs of future wildfires.

The Alberta FireSmart program and the associated Forest Resource Improvement Association of Alberta (FRIAA) provide dedicated funding for wildfire prevention operations. To date, operations have been of a small-scale (average 14 ha), occurring in close proximity to residential buildings and municipal infrastructure and involving the use of handheld equipment. Projects of this kind serve to reduce fuel loads around communities so as to mitigate property damage in the event of regional wildfires.

To prevent wildfire from occurring at a landscape scale, many

stakeholders agree that more expansive thinning operations (thousands of hectares) are required. These operations would be mechanized, involving the use of more efficient heavy forestry vehicles (i.e., harvesters and forwarders) to mechanically thin large contiguous forest areas at scale. Operations of this kind are becoming more common in North America (see Butte County, California BDO Zone) and would have the added objective/benefit of improving forest growth and yield.

BDO Zone Assets

The advanced development of the forest industry in the Lesser Slave Region is supported by Alberta's pro-business policies and a history of recent investments in facility new builds and upgrades (including pulp mills). Wood processing facilities within the BDO Zone consume an estimated 2 million tonnes per year of wood fibre in the form of roundwood and sawmill residue. The large, consistent feedstock demand has supported the development of an experienced forestry contractor base, including large companies with over 50 employees and multiple lines.

A new project located within the vicinity of the Town of Slave Lake would also have a significant locational advantage relative to competitors. The only competitor located within 150 km of Kinuso is a sawmill-integrated pellet mill with a total annual feedstock demand of ~30,000 odt/yr. The principal feedstock types consumed by the mill (sawdust and shavings) were not rated for new projects.

For the rated sawmill residue types (chips and bark), the nearest competitors are located over 200 km from the centre point (Kinuso) and over 125 km from the industrial site evaluated for infrastructure risk (Mitsue Industrial Park). The location is, therefore, a significant asset for new projects in the Slave Lake-Mitsue area. Risks of competition with distant competitors are further reduced given the conservative method of feedstock quantity estimation: the rated quantity of wood chips and bark represents less than 30% of total annual production.

BDO Zone Liabilities

The main constraint to forest residue recovery relates to the short harvesting season and tenure holder obligations to replant. Muskeg and peat soils restrict harvesting on most sites to a six-month period during the winter (late October to mid-March). To meet forest regrowth obligations cost-effectively, forest product companies that hold tenure must ensure that tree planting and road deactivation/reclamation occur within a few months of logging.

Conventional elements of the forest supply chain, including harvesting crews, roadside processors, truckers, and replanting operations, must, therefore, cooperate closely to ensure cost-effective harvesting and hauling and compliance with forest regeneration requirements. Adding the additional task of slash pile comminution (i.e., grinding or chipping), loading, and hauling will require careful planning and coordination.

Risks associated with timing and logistics are moderately elevated by risks of scale-up. The rated quantity of forest residue would require four to five dedicated grinding operations and 20 dedicated chip trucks. While there are some comminution units and chip trailers that could be partially used in support of forest residue recovery, investments in new equipment and personnel will be required. The presence of multiple well-capitalized forestry contractors provides assurances that the required investments will be made over a scale-up period of two-to-three years.

Despite the locational advantage that a new project is likely to hold relative to competitors, competition remains a liability for the rated quantities of sawmill residue. The six pulp and paper mills within a 300 km road distance of Kinuso generate a cumulative wood fibre demand of over five million tonnes per year. Deliveries of sawmill residue produced by the two sawmills in the BDO Zone frequently occur over distances greater than 150 km. Further, a large pellet mill in Entwistle that began operations in 2018 has a feedstock demand of approx. one million tonnes per year and is

known to procure at distances of over 300 km.

The long transportation distances and high FOB pricing of wood chips (up to $100/odt) indicate that competitors in the region have a relatively high willingness and ability to pay for feedstock. Competition risks are compounded by the history of backhauling arrangements with the two BDO Zone sawmills, whereby roundwood procured by pulp mills is exchanged for wood chips produced by the sawmills.

Infrastructure Profile

Infrastructure risks were assessed with reference to a 10-acre parcel in the Mitsue Industrial Park, located 60 km east of Kinuso. The park currently supports the operations of three large wood processing facilities, including a sawmill, OSB mill, and pulp mill. The parcel is zoned for heavy industrial use, includes a former firehouse with a large garage, and has direct access to high-pressure water, natural gas, and commercial electricity.

Risks associated with road infrastructure needs and relatively high costs of electricity, labour, and land are counterbalanced by the benefits of co-location with established industry. Collaboration with experienced supply chain managers and operators improves prospects for resolving feedstock supply risks associated with logistics and scale up.

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Figure 1: Risk Indicators (Sorted by Risk Level)

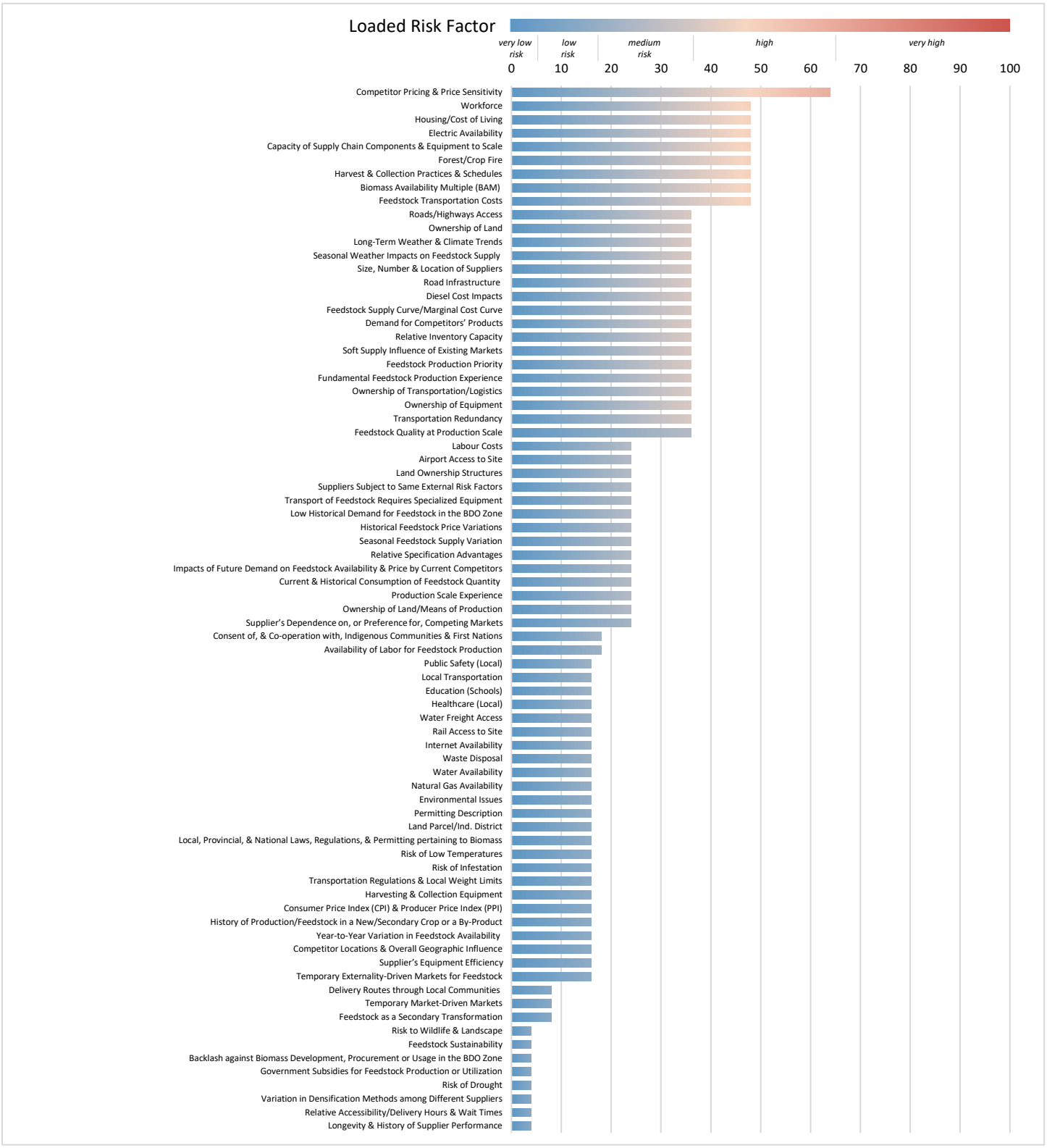


Table 1: Risk Indicators and Associated Scores

	Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
	Category 1.0: Supplier Risk					
1.1.1	Longevity & History of Supplier Performance	2	2	4	NN	4
1.2.1	Supplier's Dependence on, or Preference for, Competing Markets	4	6	24	NN	24
1.3.1	Ownership of Land / Means of Production	6	4	24	NN	24
1.3.2	Ownership of Equipment	6	6	36	NN	36
1.3.3	Ownership of Transportation/Logistics	6	6	36	NN	36
1.3.4	Feedstock as a Secondary Transformation	4	2	8	NN	8
1.4.1	Fundamental Feedstock Production Experience	6	6	36	NN	36
1.4.2	Production Scale Experience	6	4	24	NN	24
1.5.1	Supplier's Equipment Efficiency	4	4	16	NN	16
1.6.1	Feedstock Production Priority	6	6	36	NN	36
	Category 2.0: Competitor Risk					
2.1.1	Competitor Locations and Overall Geographic Influence	4	4	16	NN	16
2.1.2	Current and Historical Consumption of Feedstock Quantity	6	4	24	NN	24
2.1.3	Competitor Pricing and Price Sensitivity	8	8	64	NN	64
2.1.4	Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	4	6	24	NN	24
2.1.5	Soft Supply Influence of Existing Markets	6	6	36	NN	36
2.1.6	Temporary Market-Driven Markets	4	2	8	NN	8
2.2.1	Relative Inventory Capacity	6	6	36	NN	36
2.2.2	Relative Accessibility / Delivery Hours and Wait Times	2	2	4	NN	4
2.2.3	Relative Specification Advantages	6	4	24	NN	24
2.2.4	Demand for Competitors' Products	6	6	36	NN	36
	Category 3.0: Supply Chain Risk					
3.1.1	Biomass Availability Multiple (BAM)	6	8	48	NN	48
3.1.2	Feedstock Supply Curve / Marginal Cost Curve	6	6	36	NN	36
3.1.3	Seasonal Feedstock Supply Variation	6	4	24	NN	24
3.1.4	Year-to-Year Variation in Feedstock Availability	4	4	16	NN	16
3.2.1	Historical Feedstock Price Variations	6	4	24	NN	24
3.2.2	Low Historical Demand for Feedstock in the BDO Zone	6	4	24	NN	24
3.2.3	History of Production/Feedstock in a New/Secondary Crop or a By-Product	4	4	16	NN	16
3.3.1	Consumer Price Index (CPI) and Producer Price Index (PPI)	4	4	16	NN	16
3.3.2	Currency Risk	NR	NR	NR	NR	NR
3.3.3	Border Risk	NR	NR	NR	NR	NR
3.3.4	Temporary Externality-Driven Markets for Feedstock	4	4	16	NN	16
3.4.1	Harvest and Collection Practices and Schedules	6	8	48	NN	48
3.4.2	Harvesting and Collection Equipment	4	4	16	NN	16
3.4.3	Variation in Densification Methods among Different Suppliers	2	2	4	NN	4
3.4.4	Availability of Labour for Feedstock Production	4	6	24	25%	18
3.5.1	Feedstock Transportation Costs	6	8	48	NN	48
3.5.2	Diesel Cost Impacts	6	6	36	NN	36
3.5.3	Transport of Feedstock Requires Specialized Equipment	4	6	24	NN	24
3.5.4	Delivery Routes through Local Communities	2	4	8	NN	8
3.5.5	Transportation Regulations and Local Weight Limits	4	4	16	NN	16
3.5.6	Road Infrastructure	6	6	36	NN	36
3.5.7	Transportation Redundancy	6	6	36	NN	36
3.6.1	Size, Number and Location of Suppliers	6	6	36	NN	36
3.6.2	Suppliers Subject to Same External Risk Factors	4	6	24	NN	24
3.6.3	Land Ownership Structures	6	4	24	NN	24
3.7.1	Seasonal Weather Impacts on Feedstock Supply	6	6	36	NN	36
3.7.2	Long-Term Weather and Climate Trends	6	6	36	NN	36
3.7.3	Forest / Crop Fire	8	6	48	NN	48
3.7.4	Risk of Infestation	4	4	16	NN	16
3.7.5	Risk of Hail	NR	NR	NR	NR	NR
3.7.6	Risk of Flood	NR	NR	NR	NR	NR
3.7.7	Risk of Drought	2	2	4	NN	4
3.7.8	Risk of Hurricanes, Tornadoes and Strong Winds	NR	NR	NR	NR	NR
3.7.9	Risk of Low Temperatures	4	4	16	NN	16
3.8.1	Government Subsidies for Feedstock Production or Utilization	2	2	4	NN	4
3.8.2	Local, Provincial, and National Laws, Regulations, and Permitting pertaining to Biomass	4	4	16	NN	16
3.8.3	Backlash against Biomass Development, Procurement or Usage in the BDO Zone	2	2	4	NN	4
3.8.4	Consent of, and Cooperation with, Indigenous Communities and First Nations	4	6	24	25%	18

3.8.5	Food Security Concerns	NR	NR	NR	NR	NR
3.9.1	Feedstock Sustainability	2	2	4	NN	4
3.9.2	Risk to Soil Quality	NR	NR	NR	NR	NR
3.9.3	Risk to Surface and Groundwater	NR	NR	NR	NR	NR
3.9.4	Water Use	NR	NR	NR	NR	NR
3.9.5	Pesticide Risk to Human and Ecosystem Health	NR	NR	NR	NR	NR
3.9.6	Risk to Wildlife and Landscape	2	2	4	NN	4
3.9.7	Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
	Category 4.0: Feedstock Scale-up Risk					
4.1.1	Feedstock Quality at Production Scale	6	6	36	NN	36
4.1.2	Capacity of Supply Chain Components and Equipment to Scale	8	8	64	25%	48
	Category 5.0: Infrastructure					
5.1.1	Land Parcel/Ind. District	4	4	16	NN	16
5.1.2	Ownership of Land	6	6	36	NN	36
5.1.3	Permitting Description	4	4	16	NN	16
5.1.4	Environmental Issues	4	4	16	NN	16
5.2.1	Natural Gas Availability	4	4	16	NN	16
5.2.2	Electric Availability	8	6	48	NN	48
5.2.3	Water Availability	4	4	16	NN	16
5.2.4	Waste Disposal	4	4	16	NN	16
5.2.5	Internet Availability	4	4	16	NN	16
5.3.1	Roads/Highways Access	6	6	36	NN	36
5.3.2	Rail Access to Site	4	4	16	NN	16
5.3.3	Airport Access to Site	6	4	24	NN	24
5.3.4	Water Freight Access	4	4	16	NN	16
5.4.1	Healthcare (Local)	4	4	16	NN	16
5.4.2	Education (Schools)	4	4	16	NN	16
5.4.3	Local Transportation	4	4	16	NN	16
5.4.4	Public Safety (Local)	4	4	16	NN	16
5.4.5	Housing/Cost of Living	8	6	48	NN	48
5.5.1	Workforce	8	6	48	NN	48
5.5.2	Labour Costs	6	4	24	NN	24
					Average	**24.31**



Lesser Slave Region, AB BDO Zone Independent Review Committee (IRC)

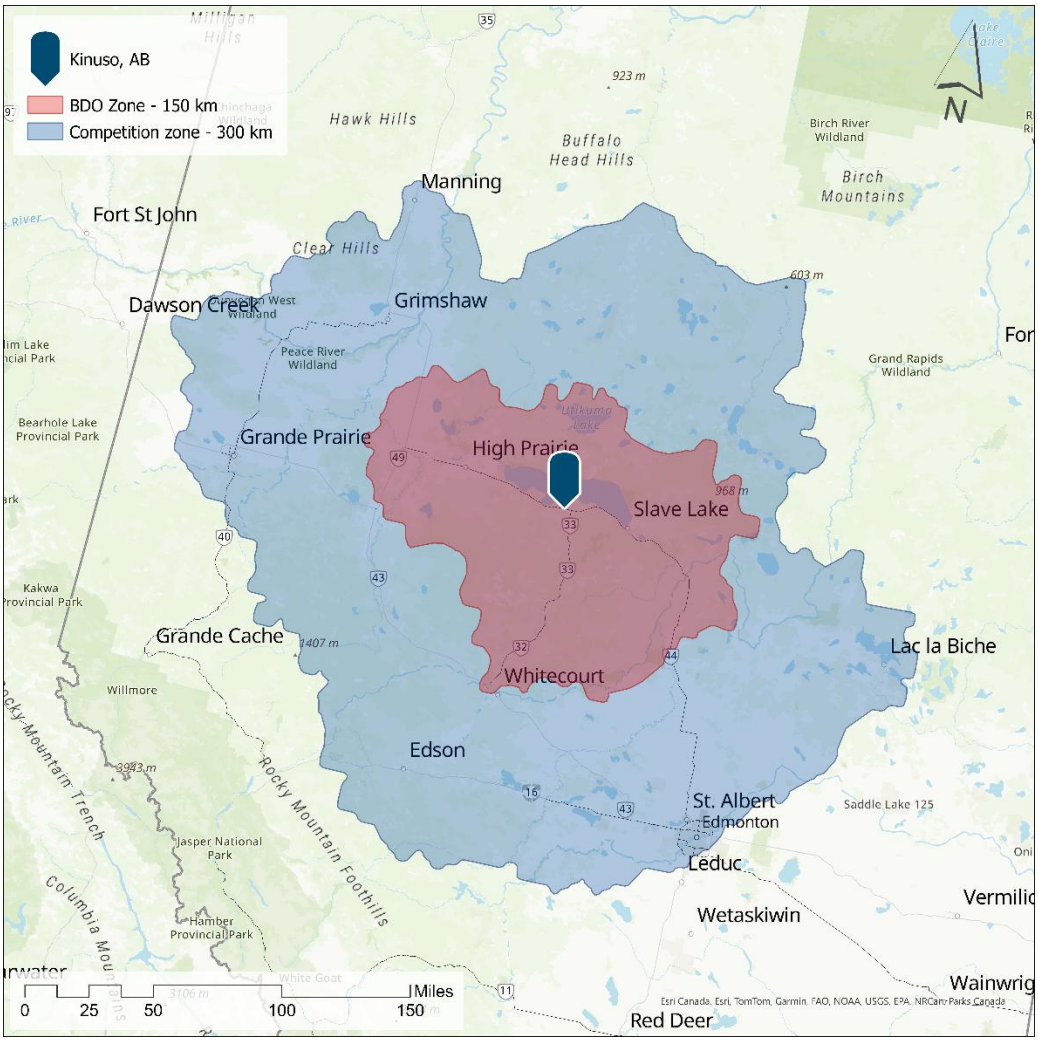
Todd Baily – Forestry/Consultation Director, Swan River First Nation
Pat Guidera – Owner, Treespective Forestry Consulting
Rudolf Liebenberg – Operational Director, Municipal District of Lesser Slave River No.124
Mike Daniels – Former owner-operator of M&M Logging (retired)
David Reynolds – Chief Accounting Officer, Big Lakes County
Toso Bozic – Consultant, ATTS Group
Vic Abel – Former public works specialist (retired)
Roberta Hunt – Councilor of Ward 4 (Kinuso), Big Lakes County

APPENDIX A: BIOMASS AVAILABILITY AND PRICING

OVERVIEW

BDO Zone Risk Indicators are scored with reference to specific feedstock quantities and prices. The rated quantities are determined by estimating the potential amount of biomass feedstock that can be produced within the BDO Zone (150-km drive distance from Kinuso, AB). This estimate of total potential is reduced based on the expected demand for biomass in the Competition Zone (300-km drive distance from Kinuso, AB). Finally, a Biomass Availability Multiple (BAM) further reduces the available amount based on a consideration of supply chain constraints (e.g., operational, accessibility, and market constraints). The resulting rated feedstock quantities are conservative estimates of availability for new projects. The price range associated with each rated quantity is determined through outreach and market analysis in the Competition Zone and reflects the anticipated price that a new bio-project would have to pay to secure the rated quantity of biomass. The Lesser Slave Region, AB BDO Zone and Competition Zone are shown on Map A-1.

Map A-1: Map of BDO Zone (red) and Competition Zone (blue)



Evaluated Feedstocks

Sawmill residues: Byproducts of sawmill operations produced from conversion of sawlogs into lumber and finished wood products. A typical lumber mill converts about 50-60% of sawlogs into finished wood products. The remaining portion (40-50%) of sawn timber is transformed during milling into sawmill residue, including wood chips, sawdust, shavings, and bark.

Forest residues: Low-grade undersized logs and components of trees that cannot be sectioned into logs (i.e., sawlogs or pulp logs) and recovered during conventional logging operations. Forest residue is typically comminuted into smaller, more homogenous particle sizes using mobile chippers or grinders. Alternatively, forest residue can be loaded into container trucks and comminuted at a terminal yard or at the destination facility. A third option made possible by the relatively low utilization in the region is to section logs from discarded top portions of trees: logs >16 feet in length can readily be produced from the tops of softwood stems (4 inch large-end diameter, 1 inch small-end diameter) and transported with conventional logging trucks. Note that low grade undersized hardwood logs and top material that could be produced on private and First Nations timberlands in the BDO Zone is also included in this category.

Supply Analysis

Sawmill Residues

There are two sawmills located within the BDO Zone with a combined lumber production capacity of 350 MMBF/year. We estimate that total annual sawmill residue production by the two sawmills is approximately 160,000 odt/yr, not including shavings (Table A-1). All material is derived from coniferous species.

Table A-1: Sawmill Residue Production and Pricing, by Type

	Quantity produced (odt/yr)	Price range ($/odt FOB)
Wood chips	100,000	75-100
Sawdust	30,000	50
Shavings	N/A	N/A
Bark	30,000	5-10
Total	**160,000**	**5-100**

There are an additional ten sawmills located outside of the BDO Zone in the competition zone, 150-300 km from Kinuso (Map A-2). It is unlikely that new projects located in the vicinity of Kinuso-Slave Lake-Mitsue will be capable of procuring sawmill residues from these sawmills for reasons related to co-location with pulp mills and other competitors (see Map A-2 below) and transportation costs. These mills are therefore not considered in the analysis. The entire potential quantity of sawmill residue is located within a 75 km drive of Kinuso (Figure A-1).

Map A-2: Location of Sawmills Within a 300-km Drive Distance of Kinuso, AB

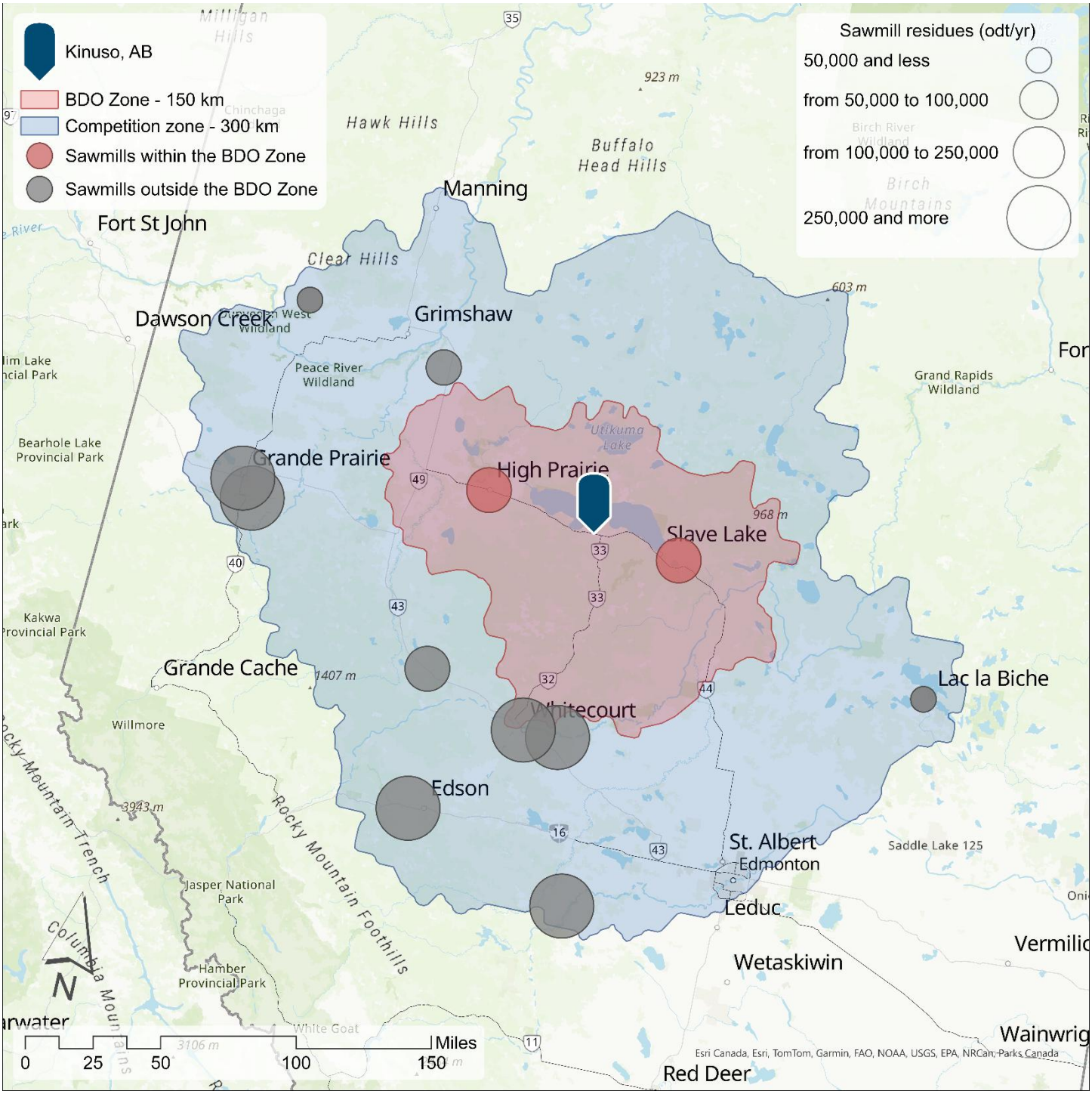
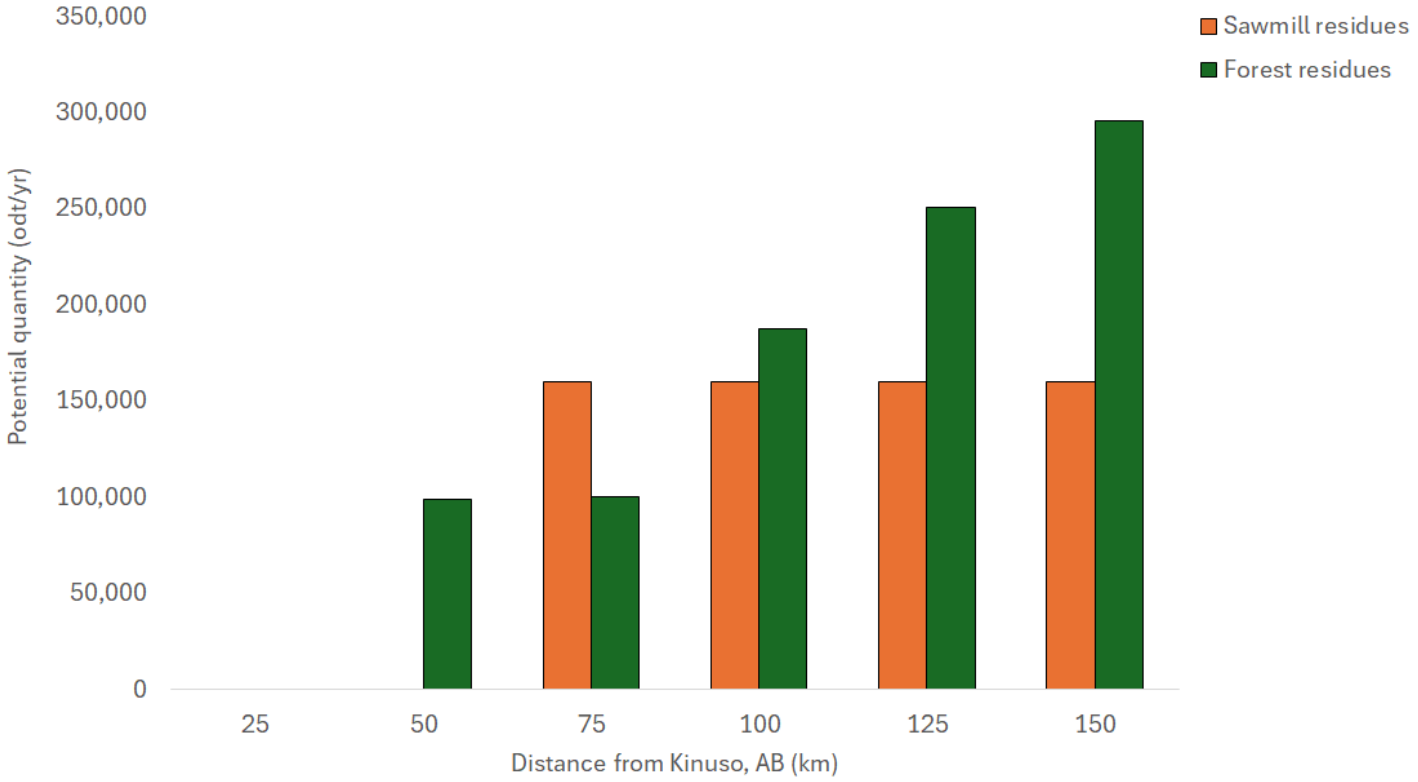


Figure A-1. Supply Curves for Sawmill and Forest Residue



Forest Residues

To estimate the amount of forest residues that are produced annually as a byproduct of forest operations in the BDO Zone, a residue recovery factor was applied to the estimated annual roundwood harvest within the BDO Zone. Forest residue supply was estimated for public ("Crown") forests, private timberlands, and First Nations timberlands. The majority of managed forests in Alberta are owned by the Government of Alberta and are managed in discrete geographic units (referred to as "Forest Management Units" or "FMUs"). Each FMU is associated with a total quantity of timber that can be sustainably harvested annually (referred to as the "Annual Allowable Cut", or "AAC"). To estimate the annual roundwood harvest from public lands, it was assumed that 80% of the AAC within the FMUs would be harvested in future years.[1] The estimates of roundwood harvest by FMU were then adjusted based on the percentage area of each FMU that overlapped with the BDO Zone. A residue recovery factor of 0.1 odt residue per 1 m^3 of roundwood was then applied to the annual roundwood harvest estimate. The residue recovery factor is based on previous research in British Columbia.[2] The final estimate of forest residue production from public timberlands in the BDO Zone derived from these assumptions is 300,000 odt/yr (Table A-2). The majority of forest residue from public timberlands is likely be sourced over 100 km from Kinuso (Figure A-1).

[1] Local forestry professionals contacted during outreach indicated that AAC utilization can be expected to approach 100% for both coniferous and deciduous species in the coming years. At the same time, AAC levels are expected to decline in the long term. Therefore, we believe this estimate is conservative, representing a middle ground between expectations of industry demand and long-term trends towards conservation.

[2] A study by FPInnovations in 2018 found that 0.134 odt of forest residue per 1 m^3 of harvested roundwood could be recovered in the BC Interior (www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/timber-tenures/fibre-recovery/tr2018n7.pdf). This estimate of recovery was rounded down to 0.1 odt per 1 m^3 of roundwood.

Table A-2: Expected Annual Forest Residue Production from Public Forests in the BDO Zone

FMU	AAC (m^3/yr)	Annual harvest (m^3/yr)	BDO Zone overlap (%)	Annual harvest in BDO Zone (m^3/yr)	Forest residue production (odt/yr)
S20	1,237,000	989,000	100	989,000	99,000
S17	1,204,000	963,000	87	838,000	84,000
W14	823,000	658,000	46	303,000	30,000
W16	768,000	614,000	49	301,000	30,000
S21	529,000	423,000	45	189,000	19,000
S19	598,000	478,000	38	182,000	18,000
S23	138,000	111,000	57	63,000	6,000
S24	38,000	30,000	100	30,000	3,000
PO5	219,000	176,000	15	26,000	3,000
S16	20,000	16,000	100	16,000	2,000
S18	423,000	338,000	4	12,000	1,000
S26	9,000	7,000	81	6,000	600
L2	239,000	191,000	1	1,000	100
Total	--	--	--	--	**296,000**

Forest residue supply from private and First Nations timberlands was estimated using private timberland harvesting data and private timberland area estimates for Alberta municipalities.[3] The relative proportion of private timberland in the Big Lakes and Lesser Slave River municipalities in total provincial private timberland was multiplied by the average annual harvest on private timberlands in Alberta over the 2011-2020 period (2,200,000 m^3/yr). The final estimates of annual roundwood harvest in the Lesser Slave Region and Big Lakes municipalities were adjusted downwards by 50% to account for the fact that private forestry activity in Alberta is concentrated outside the BDO Zone.[4]

A residue recovery factor of 0.2 odt residue per 1 m^3 of roundwood was then applied to the adjusted annual roundwood harvest estimates. The residue recovery factor is based on outreach to local forestry professionals who confirmed that private timberlands in the area are hardwood dominant, yielding a much larger quantity of unmerchantable tops and branches compared to softwood and mixedwood stands. The final estimate of forest residue production from private timberlands in the BDO Zone derived from these assumptions is 15,000 odt/yr. This is also expected to conservatively approximate potential wood supply from First Nations and Métis Settlements in the region.[5]

Note that wood supply from private and First Nations timberlands is likely to increase with the development of markets willing to pay within the range of $70-$120/odt delivered. Forestry professionals contacted during outreach indicated that wood supply from private timberlands in the region is more responsive to market prices and confirmed that the rated

[3] The harvesting data is available through the National Forestry Database (http://nfdp.ccfm.org/en/data/harvest.php) and timberland area by municipality is presented in MNP (2012). Profile of the Private Forestland Sector in Alberta. Prepared for Agroforestry & Woodlot Extenion Society. Appendix A.

[4] Based on feedback from Toso Bozic of ATTS Group.

[5] First Nations settlements in the region are held by Driftpile Cree Nation, Kapawe'no First Nation, Sawridge First Nation, Swan River First Nation, and Sucker Creek First Nation. Métis Settlements within the BDO Zone include Peavine (509,000 ha), Gift Lake (81,000 ha), and East Prairie (33,000 ha).

price range is likely to incent forest residue recovery for transport distances up to 100 km. Historical harvesting data published by the Agroforestry & Woodlot Extension Society provides further evidence of the private timberland potential. For example, in 2005 the harvest of deciduous timber from private lands was 3.5 million m^3 compared to only 750,000 m^3 in 2009.[6]

Note on Opportunities from Wildfire Prevention/Commercial Thinning Operations

Activities relevant to wildfire mitigation in Alberta are funded by the Government of Canada's FireSmart Canada program, the Alberta FireSmart program, and the Forest Resource Improvement Association of Alberta (FRIAA).[7] Fuel management through thinning and vegetation removal are eligible activities under these programs.[8] In 2023, 43 thinning projects with a combined treatment area of 612 ha were approved in Alberta. All projects will be implemented in or around communities. The average treatment area per project is only 14 ha (range: 4 – 36 ha; see Table C-1, Appendix C). All FireSmart and FRIAA projects have tended to involve the use of in situ mulchers or manual equipment (e.g., chainsaws, brush saws). Mulching is relatively cost-effective but does not enable biomass recovery.[9] The use of manual equipment matches well with the relatively small, community-scale of projects to date, but is expensive (>$15,000/ha).[10]

There is a recognized need for larger thinning operations that reduce wildfire risk over larger areas.[11] We refer to larger operations of this kind here as landscape-level wildfire prevention operations. In contrast to community-scale operations, landscape-level wildfire prevention operations involve the mechanical thinning of hundreds or thousands of contiguous hectares of forestland annually. Harvesters and forwarders are required for this purpose.[12] Note that prescribed fire is the most common method of decreasing fuel loads at a landscape scale but this does not contribute to wood supply.

Landscape-level wildfire prevention operations have yet to be proven in Canada. Similar to commercial thinning operations, high expenses are the principal barrier to implementation. Merchantable roundwood recovery from such operations will be approximately 50% lower than conventional clearcut or variable retention logging operations in most situations. Therefore, road construction, capital, O&M, and overhead costs are distributed over a smaller volume of merchantable roundwood, increasing the costs apportioned to biomass. Depending on the quality of the stand being treated, the delivered cost of biomass recovered from landscape fuel reduction operations can be up to 3x those of conventional logging operations.[13] We view wood supply from landscape-level wildfire prevention operations as a long-term prospect that requires further study and trial testing to qualify for risk assessment and investment grade rating.

Competition Analysis

There are 12 potential competitors located within the competition zone, including five pulp and paper mills, three pellet mills, and four stand-alone biopower or cogeneration facilities. Only two of the competitors are located within a 150-km drive distance of Kinuso (Map A-3, below). Note that a large OSB mill and pulp mill located within the Mitsue Industrial Park procure roundwood only and therefore will not compete with new entrants for sawmill and forest residues.

[6] MNP. (2012). Profile of the Private Forestland Sector in Alberta. Prepared for Agroforestry & Woodlot Extenion Society. Executive Summary section.
[7] https://friaa.ab.ca/programs/friaa-firesmart/
[8] https://friaa.ab.ca/wp-content/uploads/2021/01/FRIAA-FireSmart-Program-Program-Outline-for-RFEOI-21-Jan-21.pdf
[9] https://library.fpinnovations.ca/en/permalink/fpipub9563; https://library.fpinnovations.ca/en/permalink/fpipub7993
[10] https://library.fpinnovations.ca/en/permalink/fpipub7993
[11] https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/37108.pdf; https://www.ccfm.org/wp-content/uploads/2021/07/WFMWG_Action_Plan_2021-2026_en.pdf
[12] Mulchers could also be used for landscape level wildfire prevention. However, unlike mechanized thinning operations, operations involving mulchers would not be capable of recovering biomass to market and would be operationally limited to stands with a smaller average stem size.
[13] https://library.fpinnovations.ca/en/permalink/fpipub9398

Sawmill residues: Sawmill residues are fully utilized by the region's pulp and paper mills, pellet mills, cogeneration units, and biomass boilers. The ~100,000 odt/yr of wood chips produced by the two sawmills are sold to pulp and paper mills in Whitecourt (179 km), Boyle (224 km), and Grande Prairie (272 km).[14] The ~30,000 odt/yr of bark is utilized as hog fuel within the boilers, cogeneration units, and stand-alone biopower plants of Slave Lake, Whitecourt, Dapp, and Boyle.[15]

In recent years, most wood chips (100,000 odt/yr) and >80% of the bark (25,000 odt/yr) generated by the two sawmills in the BDO Zone have been delivered to facilities located over 100 km from Kinuso (Table A-3). A new project located within the BDO Zone would therefore hold a locational advantage for 125,000 odt/yr of chip and bark supplies. Note, however, that the market is highly competitive: pellet mill procurement managers in the region have been known to source sawmill residue from distances of over 300 km. Continued price competition and associated volatility is therefore likely.

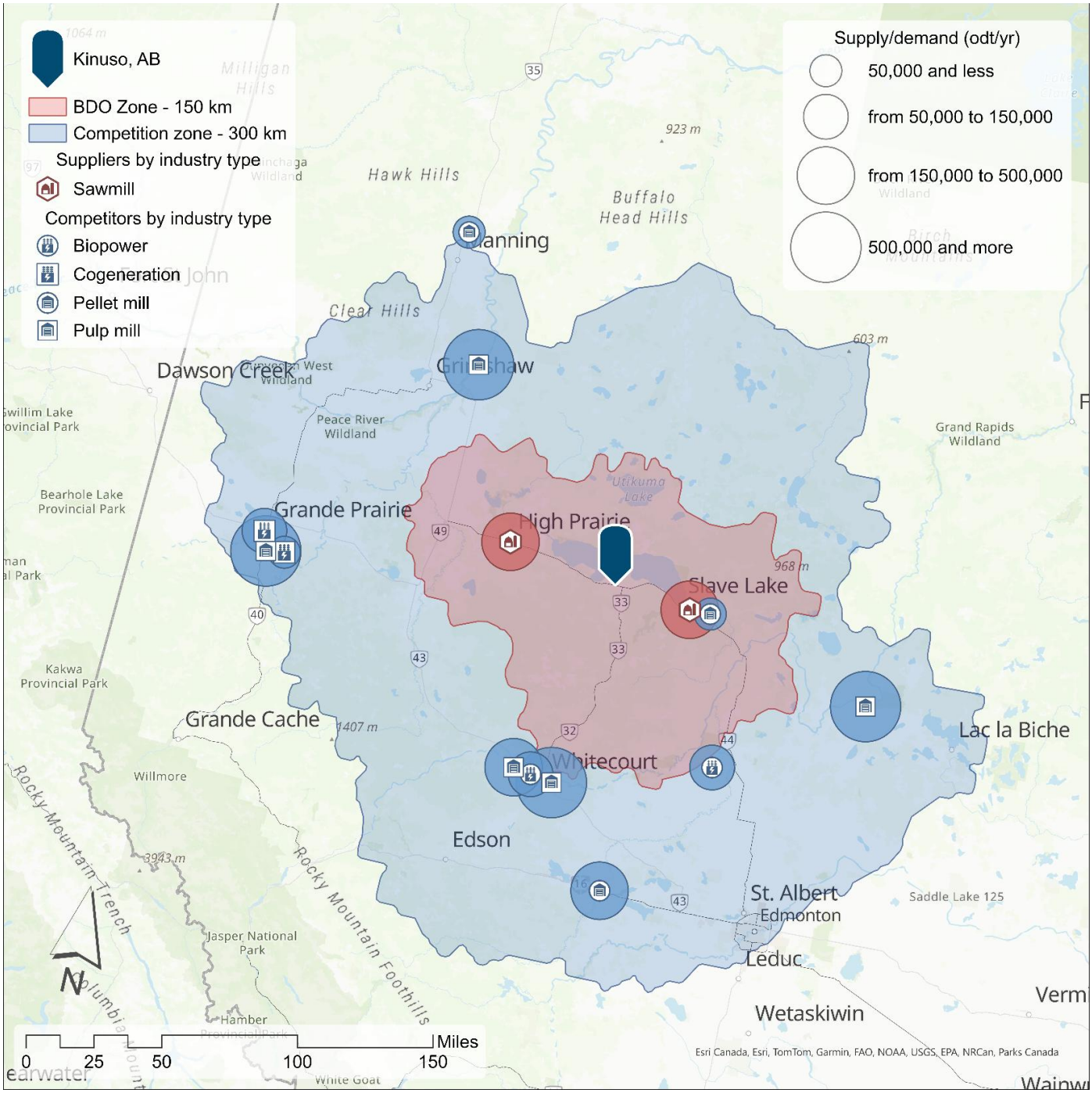
Table A-3: Current Wood Chip and Bark Delivery Distances and Quantities

	<100 km from Kinuso	**100-200 km from Kinuso**	**>200 km from Kinuso**
Wood chips (odt/yr)	0	20,000	80,000
Bark (odt/yr)	5,000	0	25,000

Forest residues: There is no history of forest residue utilization within the BDO Zone. In the broader region (outside of the BDO Zone), there are some recent examples of slash pile comminution (i.e., grinding and chipping) and in-woods chip van loading operations. Relevant experience is generally restricted to in-woods chipping operations in support of pulp mill operations to the northwest and south of Kinuso. Transportation distances are generally restricted to 100 km and there is therefore no significant utilization of, or competition for, forest residue produced within the BDO Zone.

[14] The West Fraser – Slave Lake pulp mill uses deciduous roundwood only.
[15] Hog fuel is consumed by at least five mill-based boilers and cogeneration units, including the ALPAC – Boyle pulp mill (224 km).

Map A-3: Sawmills capable of supplying new projects in the BDO Zone (red) and potential competitors (blue)



Rated Quantities and Pricing

Sawmill residues: We expect that new projects will be able to secure a fraction of the annual production of wood chips and bark for FOB prices of $75-$100/odt (wood chips) and $5-$10/odt (bark). Planer shavings and sawdust are assumed to be unavailable to new projects. To account for uncertainty in future price competition with competitors, sawmill lumber output, and other factors, the rated quantity of wood chips (25,000 odt/yr) was estimated by applying a Biomass Availability Multiple (BAM) of 4.0x. The rated quantity of wood chips is equivalent to 25% of annual production by the two sawmills in the BDO Zone and is expected to be available to a new project at low risk for a delivered price range of $100-$130/odt.[16]

A larger proportion of the bark annually produced within the BDO Zone is likely available for new projects owing to the lower value of this feedstock type and the location of competitors. The rated quantity of bark (20,000 odt/yr) represents 2/3 of the annual generation by the two sawmills (equivalent to a BAM of 1.5x). Sawdust and shavings are unlikely to be available for new projects for reasons relating to current and potential future markets and therefore were not rated.

Forest residues: The rated quantity of forest residue (110,000 odt/yr) was estimated by applying a BAM of 3.0x to the estimate of total forest residue production from public timberlands (300,000 odt/yr) and a BAM of 1.5x to the estimate of total forest residue production from private timberlands (15,000 odt/yr). For transport distances of between 75-125 km, we estimate that a new project would have to pay $70-$120/odt.[17] Supply chain configurations involving loose residue transport in container trucks followed by terminal comminution or transport of small diameter logs within conventional logging trucks would have different efficiencies and are not estimated here.

Potential quantities, rated quantities, and rated pricing for the evaluated feedstock types are summarized in Table A-4.

Table A-4: Potential and rated quantities and corresponding rated price range for evaluated biomass types

Biomass types	Potential quantity (odt/yr)	Rated quantity (odt/yr)	Rated price range ($/odt delivered)
Sawmill residues	160,000	45,000	--
-Wood chips	100,000	25,000	100-130*
-Bark	30,000	20,000	30-40*
Forest residues	315,000	110,000	70-120**

*Price range calculated using FOB of $75-$100/odt for chips and $5-$10/odt for bark, an approximate transportation distance of 70 km between the two sawmills and the center point (Kinuso), and a transportation cost assumption of $0.40/odt/loaded km.

**Assumes transportation cost of $0.50/odt/km and a transportation distance of 75-125 km. Note that transportation costs for forest residue are generally higher than sawmill residue due to lower quality road infrastructure and complicated logistics.

[16] Calculated based on sawmill locations relative to Kinuso. Assumes transportation cost of $0.40/odt/loaded km.
[17] Assumes a comminution and loading cost of $30-$35/odt and a transportation cost of $0.50/odt/loaded km.

APPENDIX B: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

1.1 Risk Factor: Credit-Worthiness/Future Solvency of Suppliers

1.1.1 Longevity & History of Supplier Performance

Rationale: Number of years in business is a positive indicator of future solvency. Historical performance is an indicator of future performance.

Risk Information: Value-added product output by the regional forest industry has remained steady over the past decade with few prolonged mill closures. This is reflected in provincial industry data. Between 2013 and 2022, total nominal GDP of Alberta's forest industry increased from $2.4 billion to $3.0 billion and employment increased from 17,000 to 19,000 (approx.).[18] Harvesting over the 2012-2021 period has averaged 23.4 million m^3/yr across the province and has not varied from this average by more than 2.9 million m^3/yr (Table C-2, Appendix C). The most recent sawmill closure within the BDO Zone was in 2013/14 (West Fraser – Slave Lake). A large capacity OSB mill in High Prairie was closed between 2021-2023 due to a fire but is reopening in 2024.

Alberta has the most technologically advanced pulp and paper industry in the country.[19] There has only been one pulp mill closure in recent years (Hinton, AB). The mill was only temporarily closed before being acquired and re-opened by Mondi Group. Regional industry performance is supported by the density of forest resources south of Slave Lake and by Alberta's corporate tax rates, which are the lowest in the country. Larger sawmills in the BDO Zone have over 150 employees (e.g., Vanderwell) and have been in operation since the 1970s/1980s.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**Score** **4**

1.2 Risk Factor: Conflicts of Interest/Vested Interest with Competing Market(s)

1.2.1 Suppliers' Dependence on, or Preference for, Competing Markets

Rationale: Suppliers may have a vested interest or preference to supply to specific competitors for biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements,

[18] https://open.alberta.ca/dataset/bcec0091-cac0-4257-a8fd-bee57b8a0e6a/resource/1b596266-003c-4ca9-b835-c24bec464613/download/fp-albertas-forest-economy-2023.pdf (p.11)

[19] The average age of pulp mills in the province is less than 40 years.

more flexible operating hours by competing markets, or suppliers' dependence on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage, such suppliers may be more likely to allocate the scarce supply to a competitor resulting in supply disruptions for the Issuer.

Risk Information: A large proportion of the wood chips produced as byproducts of sawmilling operations in the BDO Zone are delivered over 200 km to mills in Grande Prairie, Boyle, Whitecourt, and Peace River. Trades of roundwood in exchange for delivered wood chips are common. For example, in exchange for wood chips, ALPAC (a Kraft pulp mill) provides access to coniferous roundwood. Outreach to local sawmill representatives indicated that the rated quantity would likely be available to new projects at the rated price range. However, the ability of incumbents in the region to offer large quantities of roundwood in exchange for shipments of wood chips remains a risk to new projects. The extent to which ALPAC and other competitors depend on the two sawmills in the BDO Zone – and the resulting willingness of procurement managers to pay or exchange roundwood for wood chips – is uncertain.

There are no established markets for low-grade roundwood, undersized trees, and irregularly shaped tree components in the BDO Zone. Roadside piling and burning is the most common practice for managing forest residue. Firewood markets are well developed in the region but are not of a scale or specification that would pose a risk to the rated quantities.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

Rationale: Suppliers that own land where feedstock is produced, or a production facility, tend to have better control of supply chains and present lower degrees of supply risk.

Risk Information: The majority of regional forests are owned by the provincial government. Rights to harvest forest are allocated to forest product companies and other interested parties through different types of licensing and tenure agreements, the most important of which are Forest Management Agreements (FMAs). FMA holders in the region, including West Fraser – Slave Lake (S20), Tolko/Norbord/La Crete (M4), Tolko/Vanderwell/West Fraser (S17), Vanderwell (S24), Blue Ridge Lumber (W14), Alberta-Pacific Forest Industries (S23, L2), and Canfor – Whitecourt (W16), have access to 20-year forest resource rights that have a high likelihood of renewal.[20] Details of FMAs that overlap with the BDO

[20] https://www.alberta.ca/forest-management-agreements

Zone are provided in Table C-3 (Appendix C). There is some risk that parties interested in recovering forest residue to market will encounter barriers to access owing to the interests of FMA holders. Forest product companies will likely be hesitant to accommodate forest residue recovery operations (i.e., comminution and hauling) if there is uncertainty as to timelines and impacts on conventional logging and forest regeneration operations. Agreements between FMA holders and companies interested in recovering forest residue, and potentially government directives requiring FMA holder to accommodate forest residue recovery operations, will be required.

Smaller volumes of wood are supplied through quotas, , privately owned timberlands, and First Nations timberlands. The largest quotas involve volumes up to 150,000 m^3 and are typically sold to FMA holders. From 1990 to 2020, wood supply from private timberlands averaged 9% of total wood supply in Alberta (range: 1-21%, Figure C-1, Appendix C).[21] Within the study area, wood supply from private timberlands ranges from 10-20% depending on market demand and other factors.[22] Additional wood supplies are derived from First Nations and Métis timberlands.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

1.3.2 Ownership of Equipment

Rationale: In most cases, suppliers which own or lease equipment for harvest, collection and processing feedstock are lower risk than those who are not. For example, third-party harvesting equipment may not be available when required. Short harvest windows may be missed if a farmer and contractor cannot schedule harvest times that are convenient and quantity shortages can result. However, in some circumstances reliance on third-party equipment to harvest or produce feedstock can decrease supply chain risk. For example, when harvesting agricultural residues such as corn stover, the use of a third-party company with standard equipment specializing in harvesting, collection and transportation may decrease quality variations (e.g., ash content) of the final feedstock.

Risk Information: Regional logging is characterized by clearcutting and full-tree harvesting. A single operation typically includes an equipment group of 1x feller-buncher, 2x grapple skidders, and 1x processor. Harvesting equipment tends to be owned by forestry contractors. There are a number of large contractors in the region with over four lines (i.e., complements for harvesting, extraction, and processing equipment). Conversations with forestry professionals in the region confirmed that there is an oversupply for logging contractors spanning small, single-crew family-owned businesses to large companies with multiple crews and over 50 employees.

[21] National Forestry Database, http://nfdp.ccfm.org/en/data/harvest.php
[22] Based on outreach.

Recovery of the rated quantity of forest residue would likely require investments in comminution equipment. It is possible that two-to-three comminution units are available from previous operations that occurred to the northwest of the BDO Zone as recently as 2022. However, we were unable to confirm which contractors own this equipment and whether it is likely to be used to support projects in the area. The rated quantity of forest residue would require four-to-five dedicated comminution units (see Risk Indicator 4.1.2).[23]

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**Score** **36**

1.3.3 Ownership of Transportation/Logistics

Rationale: In most cases, suppliers that own or lease transportation equipment necessary to transport biomass from forest or field are lower risk than those who do not. However, in some circumstances, reliance on third parties to transport biomass is common practice and does not contribute to risk.

Risk Information: Chip vans/trailers available in the BDO Zone are owned by a mix of sawmills, forestry contractors, and third-party transportation companies. Recovery of forest residue for a new project would require up to 20 dedicated chip trucks and therefore additional investments in chip trailers, trucks, and truck operators will likely be required (see Risk Indicator 4.1.2). It is expected that much of the pre-existing sawmill residue transport capacity would like be partially allocated for forest residue transport.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment.	**Notch** **NN**

[23] Assumes 20 odt/PMH, 6-8 PMH/day, and 180 working days per year

The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100. **36**

1.3.4 Feedstock as a Secondary Transformation

Rationale: A secondary transformation dependent upon the production of primary products, e.g., forest residues, corn stover, bark, or sawmill chips (unless from a dedicated chip mill) are all secondary transformations of a primary product.

Risks are higher if feedstock is a secondary transformation of a primary, more valuable product. It may not be economical for suppliers to produce biomass on its own, in the absence of markets for the primary product. For example, a supplier may produce dimensional lumber as its primary product and wood chips as a by-product, therefore relying on the health of the housing market for production levels. If the demand for dimensional lumber drops, so can the availability of sawmill residues.

In case of agricultural feedstocks, such as corn stover, the feedstock is a by-product of a primary crop. Since the primary crop is significantly more lucrative than the residue, it will be a priority for the producer. If production of the primary crop requires resources to be taken away from the production of secondary crop (e.g., in case of shorter harvesting windows due to weather), the secondary feedstock supply will suffer. In times of stretched resources, suppliers may also perceive harvesting and collection of the feedstock as a nuisance, potentially decreasing production levels.

Understanding the economic drivers for suppliers' primary product can help gauge risk levels for secondary transformation biomass products.

Risk Information: Forest residue production is dependent on roundwood production, which is in turn dependent on the health of value-added forest product markets (e.g., lumber, pulp and paper). As reviewed in Risk Indicator 1.1.1, Alberta's forest industry has maintained a steady production level over the past decade despite the continued decline of the North America pulp and paper sector. The four pulp and paper mills in the BDO Zone have an estimated annual feedstock demand of over 4.5 million tons/yr. Much of this demand is met through sourcing low-grade roundwood (pulpwood) directly from forest operations. This demand, in turn, improves the economics of harvesting for other roundwood purchasers in the region, notably sawmills and OSB/plywood mills. Final product markets for lumber and OSB/plywood remain strong. Compared to other regions of North America, there is a relatively low risk of future forest residue production declines owing to end product market-related downturns.

Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.** **2**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100. **8**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **N**N
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 8 out of 100. **8**

1.4 Risk Factor: Supplier Experience

1.4.1 Fundamental Feedstock Production Experience

Rationale: Risk is higher when suppliers have limited experience with planting/growing/harvesting/processing and/or collecting biomass. Limited experience may be common for stover or forest residue supply chains where farmers or forestry producers may have no previous experience.

Risk Information: Some experience with in-woods comminution and chip van loading is present in the BDO Zone. Grinding operations near Peace River involved the processing of waste generated during in-woods chipping operations. In this case, the quantity of forest residues recovered was much lower than that expected under dedicated slash pile processing (the subject of the present Rating). Grinding operations managed by ALPAC – Boyle have involved the processing of legacy hybrid poplar crops. Planted in the late 1990s/early 2000s, the crops produced a sustainable, cost-effective biomass supply for the ALPAC mill. However, following an ownership change the crops are being uprooted, processed with grinders for low-quality fuel production, and returned to farmland.

Alberta Newsprint, located 159 km south of Kinuso in Whitecourt, secures a portion of its fibre supply through in-woods delimber-debarker-chipper operations. There are also companies based out of Edmonton involved in general purpose grinding, including for land clearing and pipeline construction purposes. However, we do not expect that these grinders to be employed in the BDO Zone.

Risk is assessed as medium due to the time constraints associated with forest residue recovery and lack of experience in dedicated forest residue grinding and hauling operations.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**Score** **36**

1.4.2 Production Scale Experience

Rationale: Scale-up entails risk. Risk is higher when suppliers have limited experience with the production of the quantity of feedstock required.

Risk Information: The two sawmills located in the BDO Zone have a combined 350 MMBF/yr capacity and pose no production scale experience risk for the rated quantity of sawmill residues.

The majority of the estimated 315,000 odt/yr of forest residue that is produced as a by-product of forest operations in the BDO Zone is piled at roadside and burned to reduce risk of wildfire and insect infestation. There is limited direct

experience in forest residue grinding and chip van loading. Risk is elevated due to the short window of opportunity for mobile grinding and hauling operations, and subsequent likelihood of delays. It is expected that coordination between parties involved in harvesting, grinding/hauling, and follow-on tree planting operations will improve with experience.

Risk is moderated by the size and capacity of the regional forestry contractor base. Many logging companies in the region are of relatively large scale, with over 50 employees and multiple lines operating simultaneously. This improves prospects for efficient biomass recovery from eventual forest residue operations.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

Rationale: Equipment efficiency significantly influences the supplier's feedstock production capacity. Understanding supplier's equipment capability enables understanding of their ability to produce feedstock of suitable quality.

Risk Information: The efficiency of equipment utilized in the recovery of forest residue (whether using mobile, terminal, or small log supply configurations) is at elevated risk due to time constraints. The window for slash pile processing and hauling would likely be less than one month in most circumstances and therefore would require close cooperation with loggers and tree planting personnel. The proportion of total scheduled hours spent conducting productive work could be affected by comminution unit and truck scheduling delays and traffic congestion, for example. Overall, we expect that operational efficiency will meet or exceed industry standards for comminution and hauling over a scale-up period of two-to-three years. Sawmill residue production, collection, and handling involves conventional equipment and procedures.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

1.6 Risk Factor: Supplier Motivation

1.6.1 Feedstock Production Priority

Rationale: When biomass feedstock is a secondary or non-core line of business, or when it is a by-product or a residual from a more valuable primary product, then suppliers may not put in sufficient effort for consistent production. Risk of breach increases when production and/or delivery of feedstock compromises a supplier's ability to make a primary product.

When biomass feedstock is a by-product of another main higher margin or main product (e.g., corn stover (e.g., corn) or forest residues (e.g., pulpwood)) supply may not be a top priority for a supplier.

Risk Information: The short window for comminution and chip trailer loading operations (1-2 months) elevates risk that the efficiency of sawlog and pulpwood production will be compromised. If forest residue recovery operations repeatedly impact roundwood hauling (due to increased truck traffic), tenure holders may choose to prohibit operations. There is no feedstock production priority risk associated with sawmill residues.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitor Locations and Overall Geographical Influence

Rationale: Competitors' locations relative to siting locations within a BDO Zone can affect the viability of procuring feedstock and the cost of that feedstock. Accurate and detailed competitor mapping provides an understanding of the

geographical influence a competitor may have on new plants within a BDO Zone, including competitive advantages such as short hauling.

Risk Information: There are a total of 12 competitors within a 300 km drive of Kinuso, including five pulp mills, three pellet mills, and four biopower/cogeneration units. Sawmill residues generated by the two sawmills in the BDO Zone are currently fully utilized. Wood chips are delivered over 200 km to pulp mills in Grande Prairie and Boyle. The only competitor for the rated quantities of feedstock located within a 150 km transport distance is the sawmill-based pellet line in Mitsue Industrial Park. The pellet mill consumes ~30,000 odt/yr of wood fibre annually, mainly sawdust and shavings.

A small portion of the sawdust and bark produced by the two sawmills is also used to meet internal energy demands. Remaining quantities of bark are delivered over 200 km away to stand-alone biopower plants in Whitecourt and Dapp, and to ALPAC – Boyle for use in its cogeneration unit. Note that a large pulp mill located in the Mitsue Industrial Park only purchases hardwood roundwood and therefore does not pose a competition risk for the rated quantities of feedstock.

The intake quantities and feedstock types of all identified competitors were accounted for in determining the rated quantity. The risk is therefore insignificant.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

2.1.2 Current and Historical Consumption of Feedstock Quantity

Rationale: Clear understanding of feedstock consumption by key competitors for each rated type of feedstock in the BDO Zone is essential to quantifying competitor risk.

Understanding current consumption and historical trends of feedstock utilization can provide valuable information about feedstock price elasticity during shortages, and insight into events that may impact future supply conditions. It can enable more accurate estimates of the sensitivity of feedstock availability to potential future consumption levels or to the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).

Risk Information: The entire quantity of wood chips generated annually by the Vanderwell – Slave Lake and West Fraser – High Prairie sawmills (100,000 odt/yr) is sent to pulp mills in Boyle, Whitecourt, and Grande Prairie. Most bark produced by the two sawmills is sent to cogeneration units and stand-alone biopower plants in Dapp, Boyle, and Whitecourt. No significant recent historical variation in these arrangements was discovered during outreach. Risk posed

by this pattern of consumption is assessed as medium: the pulp mills are large facilities with a demonstrated ability to pay a premium for sawmill residue transported over distances >200 km.

There is currently no consumption of forest residues in the BDO Zone. There have likely been no previous instances of production of this feedstock type within the BDO Zone and therefore historical consumption has been null. Note however that there has been some experience with roadside comminution of slash piles in areas near the NW portion of the BDO Zone. The pellet mill in Entwistle is known to procure forest residues but this supply is not likely sourced from within the BDO Zone.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

2.1.3 Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay (or receive) for different feedstock types is an essential step to determining competitiveness of Issuer and to accurate assessment of the delivered cost range in the BDO Zone rating.

Current and historical prices paid/received by competitors provide insight into their procurement behaviours and exert pressure on suppliers in the BDO Zone. Such as ability/willingness to pay premiums for feedstock during times of feedstock shortage or reduce prices (or cut off deliveries) during gluts. Competitors that have an ability to offer higher prices for feedstock during feedstock shortages can pose a significant risk to Issuer.

Knowledge of competitor pricing and price sensitivity is also an essential prerequisite to formulating a feedstock cost curve which can enable predictions of feedstock redundancy, i.e., how much feedstock could become available at different pricing levels (see Category 3–Supply Chain Risk 3.1.3).

Risk Information: Pulp mills in the region are capable of paying as high as $100/odt FOB for wood chips. After accounting for transportation costs over distances of 100-200 km, pulp mills pay as much as $180/odt to have wood chips delivered. This is very high by North American standards and is indicative of strong regional price competition. Growth in regional pellet production capacity in recent years – particularly since the construction of the Drax mill in Entwistle – has intensified price competition for wood chips and bark. The pellet mill has been known to procure sawmill residues over distances of 370 km. At current trucking rates, the cost associated with transporting over this distance is approx. $148/odt. While transportation over this distance is uncommon in the region, this indicates that competitors have an ability to pay a premium when required.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***high***, therefore the RRL is **8 out of 10.**	**8**

Raw Risk Impact (RRI) The risk impact is deemed ***high***, therefore the RRI is **8 out of 10.**	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 64 out of 100.	**Score** **64**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 64 out of 100.	**Score** **64**

2.1.4 Impacts of Future Demand on Feedstock Availability and Price by Current Competitors

Rationale: Feedstock utilization in a BDO Zone can change over time. Expansion of feedstock demand by current competitors can put additional pressure on feedstock and can lead to higher prices, feedstock disruptions, shortages or supplier breach or other types of supply chain disruption.

If current markets for feedstock have been publicly signalling the potential for increased demand for feedstock (in the case of a sawmill adding a shift, or pulp mill potentially expanding into production of renewable chemicals, for example), high interest in a supply zone can make suppliers overconfident, leading to a supplier-controlled market where short-term contracting becomes the norm and supply chain reliability is compromised for the Issuer. If and when it occurs, increased demand on feedstock may decrease availability and increase cost for new plants within the BDO Zone.

Risk Information: There are no known capacity expansion plans among the identified competitors. Pellet plant capacity within the Competition Zone (300 km drive distance from Kinuso) increased significantly in 2018 following the completion of the Drax – Entwistle facility (Figure C-2, Appendix C). The facility processes approx. 1,000,000 tonnes of wood fibre annually. The 40,000-tonne capacity pellet mill in Mitsue Industrial Park has been operating for over 15 years without any capacity expansions. The ability of the Drax pellet mill in Entwistle to procure feedstock over distances greater than 300 km and to pay for pellets generated by other pellet mills in the region slightly increases risk of future capacity expansions.

Incentives for biomass electricity generation have not been sufficient to encourage new capacity development over the past 10 years and therefore capacity expansions for existing cogeneration and stand-alone biopower units are unlikely. Significant growth in bio-electricity output in the province occurred during the 2010-2014 period as pulp and paper mills installed cogeneration units. There has been no significant change in bioenergy capacity in the province since 2014 (~400 MW, or <1% of total provincial electricity generation).[24]

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI)	**Score**

[24] https://open.alberta.ca/dataset/bcec0091-cac0-4257-a8fd-bee57b8a0e6a/resource/1b596266-003c-4ca9-b835-c24bec464613/download/fp-albertas-forest-economy-2023.pdf (p.17)

The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

2.1.5 Soft Supply Influence of Existing Markets

Rationale: In some cases, existing markets for feedstock may be able to exert high degrees of pressure over local suppliers, effectively enabling control of feedstock, especially during times of shortage. This control can derive from qualitative or "soft" factors, such as long previous relationships between local suppliers and existing markets for feedstock.

Risk Information: Pulp mills in the region are known to provide roundwood in exchange for wood chips. Backhaul arrangements of this kind can put competitors at a relative advantage during periods of feedstock shortage. Overall, risk that potential suppliers of wood chips and bark will prioritize current customers is assessed as medium. There is no risk associated with forest residues, as markets for this material have yet to develop in the BDO Zone.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**Score** **36**

2.1.6 Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can drive feedstock demand in unusual circumstances. A BDO Zone Rating Issuer based on corn stover as a feedstock, for example, would not typically compete with higher-end animal feed markets due to quality issues. However, in times of significant hay shortage (e.g., during drought), farmers use corn stover in place of hay, driving the price of feedstock and decreasing availability for bio-projects.[25]

[25] Bergtold, 2018.

Risk Information: The oil and gas industry infrequently purchases sawmill residues (particularly sawdust) for purposes of environmental remediation. Continued growth in the regional oil and gas industry is expected, presenting an elevated risk to sawdust supplies only: procurement of wood chips and bark for this purpose is unlikely. Firewood markets in the region depend mainly on white birch and are unlikely to pose a risk to the rated quantities of forest residue. The region lacks other businesses and resources that could lead to future competition. For example, custom wood processing facilities capable of utilizing forest residues are not present in the area.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 8 out of 100.	**8**

2.2 Risk Factor: Specific Competitors' Competitive Advantage

2.2.1 Relative Inventory Capacity

Rationale: The more inventory a competing biomass facility is able to store, the more competitively pressure it can exert on supply. Ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the Issuers plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets thereby creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.
Risk Information: Pulp mills in the region have large yards and wood rooms enabling the storage of up to one year's worth of roundwood. High storage capacities are necessary to contend with the lack of logging activity during the spring and summer months. The enormous ability of competitors to stockpile, coupled with their known ability and willingness to supply large quantities of roundwood in exchange for wood chips, elevates risk to new projects.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

2.2.2 Relative Accessibility/Delivery Hours and Wait Times

Rationale: The value attributed by suppliers to local competing markets for biomass is often directly related to the degree of flexibility the market provides in terms of delivery hours, and the more efficiently discharge can occur.

Risk Information: Due to the long distance of competitors relative to a new project located within the Kinuso – Slave Lake – Mitsue Industrial Park area, relative accessibility of competitors is assessed as very low risk.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**4**

2.2.3 Relative Specification Advantages

Rationale: When choosing a market for biomass feedstock, suppliers not only look at price, but also at relative quality requirements or specifications. It is important to understand feedstock quality specifications for competing markets within the BDO Zone, in order to accurately quantify the risk that competitors can exert on the Issuer's supply chain.

Risk Information: Most of the larger identified competitors, including IP – Grande Prairie, ALPAC – Boye, and Drax – Entwistle, consume both wood chips and hog fuel (bark). Drax is known to procure forest residues in areas closer to its Entwistle facility. Coupled with the high willingness and ability to pay for feedstock, risk is slightly elevated due to these factors.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**

The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

2.2.4 Demand for Competitors' Products

Rationale: Increased demand for the competitor's final product can cause an increased demand for feedstock by the competitor. For example, an increased demand for wood pellets due to high energy prices in Europe or for biofuels due to a favorable clean fuels policy can cause increased pellet/biofuel production by competing markets. Thereby driving demand for feedstock within a BDO Zone.

Risk Information: The Drax – Entwistle operation poses the largest risk in terms of potential increases in demand for competitors' products. Drax pellet use is subsidized by the UK government. In addition, the demand for wood pellets in Asia, in particular Japan, has been growing and the pellet plants in Western Canada are currently supplying this demand. Subsidies have encouraged the development of a network of pellet mills in North America capable of manufacturing and shipping pellets overseas in quantities exceeding three million tonnes per year. The ability for procurement managers at Drax – Entwistle to pay for sawmill residue deliveries over distances >300 km and to pay directly for pellets produced by other mills in the region is indication that the UK pellet market (as driven by electricity subsidies) poses significant risk to new projects.

With regards to biomass electricity generation, sawmill owner-operators with biomass electricity generation assets who were contacted during outreach noted that the deregulated Alberta electricity market is volatile, discouraging new investments in biomass-to-electricity units. However, they also noted that any sustained increase in electricity prices would lead to greater internal use of sawmill residues (particularly sawdust and bark) for electricity generation. This is unlikely but merits consideration.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**

The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

Category 3.0: Supply Chain Risk

3.1 Risk Factor: Feedstock Availability

3.1.1 Biomass Availability Multiple (BAM)

Rationale: Biomass Availability Multiple (BAM) indicates the degree of redundancy in an Issuer's supply chain in relation to the rated quantity in the BDO Zone. BAM is the mean ratio of biomass feedstock available to a project, in relation to delivered cost, divided by the Issuer's mean rated quantity. BAM is a strong indicator of supply chain resilience when stressed by supply shortage and/or supplier breach. BAMs of 1.5 or higher are generally signals of lower feedstock risk for new projects in BDO Zones.

Risk Information: The rated quantity of sawmill residue was derived by applying a BAM of 4.0x to total estimated wood chip production (100,000 odt/yr / 4 = 25,000 odt/yr) and a BAM of 1.5x to total estimated bark production (60,000 odt/yr / 1.5 = 40,000 odt/yr). The more conservative estimate for wood chips reflects the high concentration of pulp and paper mills in the region and existing backhaul arrangements (i.e., exchanges of wood chips for roundwood). Overall, despite the conservative BAM applied, the dependence of the pulp and paper industry on wood chips increases supply uncertainty for new projects. The more optimistic BAM of 1.5x for bark is justified by the comparatively low recent pricing for hog fuel (<$10/odt FOB) and the long distances over which hog fuel is currently transported (>150 km). A new project located in the Kinuso-Slave Lake-Mitsue area is likely to capture the majority of the annually generated quantity.

To determine the rated quantity of forest residue, a BAM of 3.0x was applied to the estimate of the quantity of forest residue that is produced and piled as slash annually. There are currently no buyers of forest residue in the BDO Zone and therefore we expect that this quantity could be available for new projects at very low risk of competition. Note that recent wildfires have affected a large area in the BDO Zone, elevating wood supply uncertainty. The BAM of 3.0x is expected to account for this.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***high***, therefore the RRI is **8 out of 10.**	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.	**Score** **48**

3.1.2 Feedstock Supply Curve/Marginal Cost Curve

Rationale: The greater the feasible transport distance, the more feedstock is accessible to the Issuer, but at a higher delivered cost. The feedstock supply curve, sometimes referred to as the marginal cost curve, is a function of feedstock availability over its cost which is primarily, but not exclusively, a function of distance. The feedstock supply curve is used to determine the availability of redundant feedstock at various price points, and the cost of replacing feedstock with substitutes located at different distances.

Feedstock cost curves are useful in determining supply chain resilience; they provide information about the cost of feedstock availability in times of supply disturbance. Biomass supply chains are prone to supply disturbances over time; suppliers can become insolvent, or weather events can temporarily disrupt feedstock availability. When a disturbance occurs, the Issuer may need to source replacement feedstock from different suppliers at different locations and costs. A biomass supply curve indicates quantities of feedstock available at various price levels from suppliers generally located further away than the core supplier.

Risk Information: The two potential suppliers of sawmill residues in the BDO Zone are located within a 75 km drive distance of Kinuso. For a new project located within the Mitsue Industrial Park, it is likely that the entire rated quantity will be available within a 5 km drive distance (from the co-located Vanderwell sawmill). To estimate the geographic distribution of forest residues, we assumed that the distribution is approximated by the geometric centre point of each FMU in the BDO Zone. Using this method, we estimate that >50% of the total potential quantity is located over 100 km from Kinuso, increasing risks associated with diesel price volatility and other factors relevant to transportation economics (Figure A-1, Appendix A).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

3.1.3 Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal supply variations. Seasonal supply variations combined with limitations associated with longer-distance transportation and storage can lead to BDO Zone biomass supply imbalances[26] and can manifest in shortages and higher costs for Issuers.

Risk Information: The logging season generally lasts nine months, from June to March. Logging activity is concentrated during the winter months due to the prevalence of muskeg (i.e., swamps or bogs with mossy substrates). Summer logging occurs on well drained upland sites with sandy soils. Logging does not occur during the spring when soil

[26] Golecha & Gan 2016.

conditions increase risk of operational inefficiency and residual stand damage. Wet operating conditions encountered during the logging season, which are common during the months of February and March, are circumvented by concentrating logging activity during the evening and overnight when temperatures are subzero.

Stockpiling is a conventional means by which seasonal disruptions in wood supply are mitigated. Inventories are built up during the winter months when logging activity is highest. There is also regional experience with an innovative approach to improving road conditions. Referred to as "engineered road wood fibre," the approach involves the use of ground wood fibre distributed and compacted along roadways.[27] The material produces a durable mesh that is capable of maintaining road structure in the off season during wet, muddy conditions. The approach is patented and testing was carried out in the area in 2012 but the approach has never been adopted at scale.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

3.1.4 Year-to-Year Variation in Feedstock Availability

Rationale: Biomass can have significant year-to-year supply variations due to variability in yield from biomass harvesting operations, particularly with agricultural biomass.

Risk Information: Plausible causes of year-to-year variation in wood fibre availability, including volatility in wood product manufacturing, volatility in harvesting levels, and natural disturbances, have not been a significant issue. The forest industry has experienced consistent output since recovering from the 2007-2008 financial crisis and major wildfires in 2019 did not impact regional wood supply chains.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**

[27] https://www.fs.usda.gov/t-d/pubs/pdfpubs/pdf20771810P/2077_1810P_Stab_Sand_Rds_150_dpi_508_02-09-21.pdf

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

Rationale: If volatility is shown in the historical feedstock price, then the risk of future price fluctuation is elevated. If feedstock prices have historically exceeded the price at which the Issuer would have to cease operations or breach a financial covenant (i.e., the "red line" feedstock cost), then mitigation measures should be put in place.

Risk Information: Volatility in sawmill residue prices is reflected in the rated price ranges. Wood chip pricing ranges from $75-$100/odt FOB and competitors in the region have been willing to pay up to an additional $80/odt for transportation (200 km). Pricing for bark ranges from $5-$10/odt FOB and has been transported up to 200 km. Typical transportation distances for hog fuel/bark are <150 km. Markets for forest residue and biomass from fuel reduction treatments have yet to develop. While the likelihood of future price swings is assessed as a medium risk (particularly for wood chips), the impact of future volatility on new projects is assessed as low due to the conservatively estimated rated quantities (e.g., the rated quantity of wood chips is 25% of expected annual production by the two sawmills in the BDO Zone).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

3.2.2 Low Historical Demand for Feedstock in the BDO Zone

Rationale: If Issuer BDO Zone does not have a history of developed, large-scale feedstock procurement, suppliers may not have sufficient expertise in feedstock production to ensure reliable supply, especially in early years. This can be particularly true for forest residues, where typically the infrastructure for collection, processing and delivery is immature.

Where supply chains are not well-established, risk can be mitigated when new bio-based plants control a higher degree of feedstock processing. For example, if a BDO Zone rating is issued for clean wood chips and the historical demand in the Zone has been exclusively for pulpwood, then supply chain risk will be decreased for new bio-based plants that intake pulpwood and manage log debarking and chipping internally. Rather than requiring inexperienced suppliers to deliver debarked wood chips.

Risk Information: While demand for forest residue produced from forest operations in the BDO Zone has been non-existent to date, demand has been present in northwestern and eastern areas of the Lesser Slave region, around the Town of Whitecourt in the south, as well as in the Swan Hills region further south (~250 km from Kinuso). Suppliers in these areas have had experience with in-woods chipping for pulp mill supply, poplar plantation salvaging via grinding, and more recently forest residue (slash pile) comminution for pellet mill operations. This experience in the broader region moderates risks associated with low historical demand for forest residue operations in the BDO Zone. There is no risk associated with sawmill residues.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

3.2.3 History of Production/Feedstock is a New/Secondary Crop or a Byproduct

Rationale: If feedstock is a new/secondary crop or a by-product, suppliers may either lack sufficient experience to mitigate risk, or be unable to react to such risk. Secondary crop or by-product producers may be less likely to prioritize production.

For new crop types, inexperience in planting, harvest, collection, and yield data may pose higher levels of risk.

If feedstock is a secondary transformation (i.e., wheat straw, corn stover, or forest residue), then production can be subject to variables beyond suppliers' control (e.g., changing demand for sawtimber, or primary crop prices).

Risk Information: As described in Risk Indicator 3.2.1 above, comminution experience in the broader region is extensive. However, there are currently no suppliers of forest residue in the region. The risk associated with reduced harvesting activity in response to future downturns in lumber and/or pulp markets is deemed low owing to the comparatively strong performance of Alberta's forest sector over the past decade (see Risk Indicator 1.1.1, for example).

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**

Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

3.3 Risk Factor: Non-Weather Based Externalities

3.3.1 Consumer Price Index (CPI) and Producer Price Index (PPI)

Rationale: CPI and PPI can impact feedstock cost of harvest and collection over time. Sensitivities to worst case scenarios should be run.

Risk Information: The Canadian CPI increased significantly during COVID-19 and associated lockdowns. Costs of important inputs to sawmill and forest operations increased during this time. However, this did not affect harvesting and consequent residue generation. In recent years, prices in Alberta have closely tracked with the national average (Figure C-3, Appendix C).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

3.3.2 Currency Risk

Rationale: Where feedstock is purchased in a currency different than that which a new bio-based plant will locate in a BDO Zone, currency exchange rates and volatility can constitute risk exposure. BDO Zones that cross the US-Canada border, for example, which intake feedstock from both countries, are exposed to such currency risk.

Risk Information: Not rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**

The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

3.3.3 Border Risk

Rationale: Where feedstock is transported cross-border to another country, risk exposure to border closures and crossing delays becomes present. The availability of trucks willing to do cross-border runs is limited, which can decrease supply chain flexibility and resilience. Plants near the US-Canada border, which intake feedstock from both countries, are exposed to these risks.

Risk Information: Not rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

3.3.4 Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. For example, an Issuer using corn stover as a feedstock would not typically compete with the higher-end animal feed market. However, in times of significant hay shortage (e.g., during drought), farmers may use corn stover as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects.[28]

Risk Information: The regional firewood market favours white birch and is not expected to pose a risk to the rated quantity of forest residue. The oil and gas industry occasionally has a demand for sawmill byproducts for purposes of road construction.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**

[28] Bergtold, 2018.

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

3.4 Risk Factor: Risks Related to Feedstock Production, Harvest and Collection

3.4.1 Harvest & Collection Practices & Schedules

Rationale: Differences in harvest timing and practices used can create risk to both the quantity and quality of feedstock. For example, feedstock harvested by different suppliers in different windows can undergo varying levels of exposure to sun, wind, and moisture, leading to variations in delivered feedstock quality.

For example, agricultural feedstocks and energy crops have optimal harvesting windows to ensure minimal moisture content. In certain BDO Zones these harvesting windows may coincide with heightened weather risk, such as frost or rain.

For forestry biomass, unsightly clearcuts and slash piles (even on plantation forests and especially when located near communities) can provoke unwanted public backlash even when suitable and sustainable replanting regimes are followed.

Risk Information: The main constraint to forest residue recovery relates to regulations that require FMA holders to deactivate/reclaim logging roads within two years. The preference among contractors and forest managers is to deactivate and replant roads and cutovers immediately following harvesting, as this maximizes use of already-deployed capital and manpower. In addition to the road deactivation and reforestation constraints, the Government of Alberta requires FMA holders to remove or burn slash piles within 12-18 months. These issues of timing are compounded by the unpredictability of forest planning: we confirmed through outreach that forestry contractors are often given short notice as to the location and duration of operations.

Scheduling slash grinding and chip van loading operations is therefore challenging, requiring careful planning and cooperation among all parties. With forest residue recovery, the typical sequence from harvesting to planting is expected to involve the following: Forest operations – merchantable roundwood transport off-site – slash pile grinding and transport off-site – road deactivation and reclamation (including tree planting). The window for forest residue recovery is expected to be less than one month in most cases. The unpredictability of harvesting location adds further uncertainty to the success of forest residue procurement at scale in the BDO Zone.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***high***, therefore the RRI is **8 out of 10.**	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**

Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.	**Score** **48**

3.4.2 Harvesting & Collection Equipment

Rationale: Different types of harvesting and collection equipment used by suppliers in a BDO Zone can have a significant impact on the quality and availability of feedstock. Use of different types and combinations of harvesting, collection and processing equipment among suppliers can lead to non-homogeneous feedstock. Equipment that is not designed specifically for biomass cultivation, harvesting and collection, can increase feedstock quality risks.

Relevant equipment should be specified for the sake of product consistency and risk reduction.

Risk Information: The region's forest operations are characterized by full-tree, clearcut harvesting. Felling, yarding, and roadside processing are carried out using feller-bunchers, grapple skidders, and processors, respectively. Comminution would be followed by transportation in chip vans/trailers. Alternatively, container trucks could be used to transport loose residue to the Mitsue Industrial Park from stationary comminution. When appropriately managed and operated, none of this equipment presents a risk to feedstock quality or availability.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

3.4.3 Variation in Densification Methods Among Different Suppliers

Rationale: The shape and density of the unit in which feedstock is supplied can impact feedstock cost and quality. Standard feedstock densification modes for biomass consist of round or square bales, pellets, cubes, chips, or grindings. The size of wood fibre processed in a grinder is less homogenous than if a chipper is used.

Bales of different densities can absorb moisture at different rates. In certain cases, round bales have been viewed as problematic due to their uneven moisture content distribution.[29]

Risk Information: Feedstock variation is unlikely to impact new projects as long as procurement managers specify feedstock quality expectations and manage the supply chain accordingly. Suppliers have been meeting the demand of pulp and paper, wood pellet, and cogen/biopower plants.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**4**

3.4.4 Availability of Labour for Feedstock Production

Rationale: Skilled labour shortages can be difficult to remedy in the short-term. Availability of suitable labour in an area can impact the ability to procure sufficient feedstock quantities on required schedules. Labour risks are higher where supply chains are not yet active; or for Issuer's for whom large feedstock requirements, or development of new (or expanded) supply chains, demand significant additions to the local labour force.

Risk Information: We determined through outreach that it is sometimes difficult for logging contractors to retain and attract equipment operators, a problem common to North American forestry. Many equipment operators working in Alberta and BC are from out-of-province (e.g., Quebec, the Maritimes). However, this problem has not limited logging operations in the region. Shortages of truck operators, in contrast, do lead to operational slowdowns and shutdowns: lumber production was temporarily constrained during the period of high lumber prices in 2020-21 due to a lack of available truck operators. Dimensional lumber products that would otherwise have been milled and sent to market were not. The main causes of this situation in the Lesser Slave Region are higher wages in the oil & gas industry and the relatively low population size. Truck operators and potential equipment operators tend to prefer working in support of oil and gas operations due to the higher pay.

Risks are moderated by the presence of the employer-led Woodland Operations Learning Foundation (WOLF). WOLF offers business and operational courses to individuals and businesses in Alberta. Courses have included equipment maintenance and service, simulator training, and log driver training.[30] The Board of Directors is composed of representatives of forest product companies that are based in the BDO Zone. Note that the WOLF program has lower enrollment compared to previous periods (e.g., early 2000s). Training is still predominantly provided by employers without support from WOLF, Northern Lakes College, or other institutions.

[29] Huhnke, 2018.
[30] https://www.w-o-l-f.ca/training-programs/

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* A new proponent willing to invest time and resources in increasing the scope and enrollment of the WOLF program would likely experience a return on investment in the long run. The WOLF program remains active and is headed by most large forest companies in the region. Enrollment is down compared to earlier periods (e.g., the early 2000s) but all institutional infrastructure required for the program remains in place. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is 25%.	**Notch** **25%**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 18 out of 100.	**Score** **18**

3.5 Risk Factor: Transportation

3.5.1 Feedstock Transportation Costs

Rationale: Transportation can be one of the most significant cost components of biomass supply chains. The average transport cost and percentage of total feedstock cost attributable to transport should be known.

Transport distances of 80-120 km for biomass feedstocks are typical but larger distances can be common. Where average transport distance from suppliers to Issuer is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and by the demand for scarce feedstock from competitors closer to the source.

Understanding average transport distance can help flag higher-risk BDO Zones where transport distance materially exceeds the average.

Risk Information: Local forestry professionals contacted during outreach by Ecostrat indicated an average expected transport distance for forest residue of 100 km. This is confirmed by the supply curve generated on the basis of the assumption that the geometric centre points of FMUs approximate transport distance (Figure A-1, Appendix A). Feedstock transportation costs are also at risk of increasing beyond $0.50/odt/km due to seasonal and operational factors. For example, trucking companies may charge more to operate chip trailers in cutblocks owing to short operating windows, traffic congestion, and risk of trailer damage. Sawmill residue transportation costs ($0.40/odt/km) are at lower risk of increasing beyond the range implied by the rated pricing (bark: $30-$40/odt, wood chips: $100-$130/odt).

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***high***, therefore the RRI is **8 out of 10.**	**Score** **8**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**Score** **48**

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.	**48**

3.5.2 Diesel Cost Impacts

Rationale: Changes in diesel cost impact transport cost over time. Sensitivities to worst case scenarios should be run.

Risk Information: Diesel prices in Alberta are the lowest in the country. On average, Canadian diesel prices over the 1990-2023 period were 12.9% higher than Alberta prices (Figure C-4, Appendix C). However, the expected continued increase and volatility in global and regional fossil fuel pricing increases risk to medium.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

3.5.3 Transportation of Feedstock Requires Specialized Equipment

Rationale: Requirements for specialized transport equipment (e.g., walking-floor trailers) can increase supply chain risk. Where there is low availability in required transportation equipment, equipment owners have increased leverage over transportation prices and supply chain resiliency can be lower.

Risk Information: Shortages of conventional logging trucks and chip trailers are known to occur during periods of elevated logging and milling activity. While this has not impeded the transportation and exchange of sawmill residues to date, we expect that the introduction of demand for hauling of comminuted forest residues will introduce challenges to the regional transport fleet. Additional investments in chip trailers, trucks, and truck operators will likely be required to ensure timely deliveries of the rated quantity of forest residue (see Risk Indicator 1.3.3 and 4.1.2).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**

Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

3.5.4 Delivery Routes through Local Communities

Rationale: Transportation of biomass can become a nuisance to local communities, especially if a large number of trucks pass through residential and school areas. Local communities often have power to force regulations regarding truck transport, impeding the ability BDO Zone suppliers to transport feedstock.

Risk Information: Forest vehicle traffic is a common occurrence in the region. For example, over 1,300 commercial vehicles travel to and from the Mitsue Industrial Park each day.[31] Many municipalities have dedicated dust control programs which involve the application of calcium chloride on gravel roads. Delivery of the rated quantity of forest residue to a new project in the area would increase truck traffic by only ~2%.[32]

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 8 out of 100.	**Score** **8**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 8 out of 100.	**Score** **8**

3.5.5 Transportation Regulations & Local Weight Limits

Rationale: In many BDO Zones, transportation is regulated based on seasonal road conditions. These regulations (e.g., "frost laws") often take the form of weight restrictions or limits on the number of trucks allowed on roads. Such regulations can impede the project's ability to source sufficient feedstock or increase the cost of doing so at certain times of the year.

[31] https://mdmatters.ca/mitsue-industrial/#backgrounder-11-2022
[32] Assumes 20 additional trucks making two trips per day for 180 days a year

Risk Information: There are no significant road restrictions relevant to forestry truck traffic. All highways in the region accommodate a maximum gross vehicle weight of 65 tonnes. Secondary roadways have a typical maximum GVW of 63.5 tonnes. GVWs exceeding 63.5 tonnes are eligible for equipment exemption permits.[33] Trucks with 9 to 10 axles have been permitted to operate with GVWs up to 88 tonnes on highways. Seasonal road bans are common, particularly during the spring. Road ban permits are offered by municipalities and typically require over three business days for processing. Generally, these regulations do not impact forestry operations, which are concentrated during the winter months.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100. **16**

3.5.6 Road Infrastructure

Rationale: Feedstock cost and availability can be a function of road infrastructure, in particular the accessibility the infrastructure provides to feedstock. Issues with road networks will translate directly to risks to feedstock supply.
Risk Information: Regional road infrastructure is designed to accommodate heavy truck traffic. Primary roads are generally in a good state of repair. There is one bridge in the western portion of the BDO Zone that cannot accommodate GVWs of 65 tonnes. In addition, a bridge that provides efficient access to timberlands in the northeastern portion of the BDO Zone (Smith Bridge) is currently inoperable. Government money has recently been allocated to refurbish or rebuild the bridge but construction has not yet started. The reliability and access to the secondary and tertiary road networks in the region is affected by prevalence of peat moss substrate (muskeg). Many sites are inaccessible during the summer and spring months, as roads become soft and waterlogged. During the winter months, roads in lower elevation areas with peat substrate must be prepared by clearing off snow and allowing underlying water to freeze, followed by compaction. This can significantly increase time and costs associated with road building. Managers and operators are accustomed to winter logging and therefore this does not represent a significant risk. Generally, accessibility is very good due to the density of secondary and tertiary roads (owing in part to the oil and gas industry) and the ability to construct temporary winter roads in most areas.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.** **6**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.** **6**

[33] https://www.alberta.ca/system/files/custom_downloaded_images/tr-lhp-10-axle-b-train.pdf

Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

3.5.7 Transportation Redundancy

Rationale: Transport equipment redundancy is important for dealing with seasonally variable feedstock supplies as well as the risk of equipment breakdowns.

Risk Information: As discussed in Risk Indicator 3.5.3, the existing capacity of trucks, chip trailers, and truck operators is likely insufficient for the rated quantity of forest residue. Additional investments in equipment and personnel will be required. Note that temporary shortages of trucks and drivers have occurred during periods of high harvesting and milling activity.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

3.6 Risk Factor: Supply Chain Resiliency

3.6.1 Size, Number and Location of Suppliers

Rationale: In general, a supply portfolio involving multiple suppliers of various sizes (and from multiple BDO Zones) is important for ensuring steady and uninterrupted feedstock supply with minimal price fluctuations. If a small number of large suppliers provides a high proportion of total feedstock, a disruption or supplier breach will have greater impact on the supply chain. In such cases the risk of disruption is lower, but the impact of those disruptions is higher. Conversely, many small suppliers are less likely to have the capacity to withstand internal disruptions and thus may be

more likely to breach. Here, risk of disruption is higher, but their likely impact is lower. The number of suppliers as well as the ratio of small to large suppliers should be optimized.

There is no pre-determined number or optimal ratio of suppliers, although having too many or too few can both pose higher degrees of risk.

Risk Information: If a new project is located in the Mitsue Industrial Park, the entire rated quantity of sawmill residues (45,000 odt/yr) would likely be procured from a single sawmill. If located in Kinuso, a project would likely source its sawmill residue supply from two sawmills. While each mill is relatively large (150 MMBF/yr and 200 MMBF/yr), the small number of suppliers increases risk to lumber market downturns and other events that could reduce sawmill byproduct supply.

With respect to forest residue, there are a large number of logging contractors and companies in the region (over 25), spanning a large range of business sizes. Small contractors with a single equipment complement are supplemented by larger timber management and harvesting companies with multiple equipment complements and over 50 employees. There are an estimated two-to-three contractors in the region in possession of comminution units (e.g., grinders); these units are used primarily for urban land clearing and waste wood processing.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

3.6.2 Suppliers Subject to Same External Risk Factors

Rationale: When a single risk event can impact the feedstock production ability of all (or most) suppliers, then feedstock risk is higher and supply chain resiliency is lower. Resilience is maximized when biomass supply chains exhibit diversity in spatial location (i.e., geography), production practices and other elements of supply chain structures such that the impact of single high-risk events have varying impacts on suppliers.

Risk Information: The low diversity of sawmill residue suppliers increases risk that new projects will be unable to secure feedstock in the event of lumber market downturns or other external shocks. With regards to forest residue, potential suppliers (forestry contractors) are diverse and include both small and medium-sized businesses, increasing resilience to external shocks for the rated quantity of forest residue (60% of the total quantity of feedstock rated for new projects).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**

Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

3.6.3 Land Ownership Structures

Rationale: The ownership (or control) of the land base on which feedstock is produced can have significant impact on Issuer's feedstock risks. Risk of long-term variation in stumpage cost for wood fibre (i.e., the cost that one pays to a landowner for the right to cut and purchase their wood fibre) for example are much higher in the US where >90% of the land is private, and thus stumpage cost is determined on a competitive auction basis. Conversely, in Canada >90% of the land is owned by the Crown and stumpage is allocated by the government.

Risk Information: Over 90% of productive forests in the BDO Zone are publicly owned. Timber and biomass resources available from public lands in Alberta are allocated for sustainable use under 20-year FMA and quota tenure systems. Wood supply is relatively predictable and reliable under this system. Stumpage charges are set on the basis of market prices, increasing proportionally with forest product price increases. Stumpage charges for forest residue utilization are approx. $0.25/m^3 ($0.60-$0.65/odt). As noted in Risk Indicator 1.3.1, FMA holders will likely be hesitant to accommodate forest residue recovery operations without incentive in the form of payments and/or government directives.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

3.7 Risk Factor: Climate and Natural Risks

3.7.1 Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as those deriving from natural weather variations (i.e., spring thaws, rainy seasons, or dry seasons – as opposed to from singular weather events like fires, droughts, or hurricanes). Seasonal weather changes can be a significant risk factor affecting feedstock availability, quality, and price.

Given the major influence that weather has on multiple aspects of growing, harvesting, and transporting biomass, it is difficult to predict the availability of biomass at a specific location at different points in the future with a high degree of certainty. However, it is still possible, using past data and statistical models, to generate reasonable upper/lower bound estimates of biomass production in any given year in a wider supply zone. Such estimates are important in assessing feedstock risk and enable accurate assessment of the efficacy of Issuer's mitigation methods.

Risk Information: Harvesting activity is paused during the spring thaw, which generally extends from the middle of March to the end of June. Harvesting activity is also reduced during the summer months, particularly in low-lying stands and broader areas where roadways are affected by wet ground conditions. Forest residue recovery is most likely to occur during the winter months at peak harvesting levels and logging road traffic. There is therefore enhanced risk that the shortened harvesting season will reduce the ability for new projects to reliably procure forest residue at the rated price range without compromising conventional roundwood operations.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**Score** **36**

3.7.2 Long-Term Weather and Climate Trends

Rationale: In certain BDO Zones, climatic trends and significant potential changes to future weather patterns can create feedstock risk.

Risk Information: As noted above, seasonal weather has an important impact on forest operations in the BDO Zone, limiting operations in many areas to the six-month winter period. There is mixed evidence that operationally significant weather events – which includes the spring thaw and periods of extreme precipitation and flooding – will increase over time as a result of global warming.

Wildfires are a normal occurrence in the region. Forest fires tend to have a higher-than-average rate of spread and total fuel consumption compared to other regions in Canada.[34] Fire return intervals are normally 80-150 years. There is

[34] https://cwfis.cfs.nrcan.gc.ca/home

evidence that the annual number of large wildfires, area burned, and fire sizes increased in Alberta between 1970 and 2019.[35] Note however that the severity of major wildfires in recent years are comparable to those of the past, including a wildfire in 1919 that burned five million acres east of Edmonton.[36] Return intervals may shorten in the long-term in correspondence with global warming trends. There are no other long-term weather and climate trends deemed relevant to the rated quantities of feedstock.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

3.7.3 Forest/Crop Fire

Rationale: Forest/crop fires, especially when occurring at large-scale, destroy feedstock and create shortages.

Fire-prone conditions are predicted to increase across Canada. This could potentially result in a doubling of the amount of area burned by the end of this century compared with amounts burned in recent decades. Boreal forests, which have been historically greatly influenced by fire, will likely be especially affected by this change.

Other climate change impacts that could add damaged or dead-wood to the forest fuel load (e.g., as a result of insect outbreaks, ice storms, or high winds) may increase the risk of fire activity. New research is aimed at refining these climate change estimates of fire activity, and at investigating adaptation strategies and options to deal with future fire occurrence. There is growing consensus that as wildfire activity increases, fire agency suppression efforts will be increasingly strained. However, analyses of fire history suggest that it is the effect of climate variability on precipitation regimes that is the primary reason for the decreasing fire activity in the southern BDO Zone of Canada.

Risk Information: Large wildfires are common to the region, with fire return intervals of 80-150 years. At least three contiguous areas of forest >1,000 km^2 (>100,000 ha) within the BDO Zone were affected by wildfire over the 1980-2021 period (Map C-1, Appendix C). Wildfires have been known to directly impact the forest industry. Wildfires in 2011 prompted the evacuation of approximately 15,000 individuals and destroyed over 500 residential and non-residential structures. In 1968, a sawmill operation near Slave Lake was destroyed by a major forest fire.[37] The 2019 McMillian wildfire complex burned 255,000 hectares in the broader region, including areas adjacent to Lesser Slave Lake.[38] The

[35] https://www.fs.usda.gov/rm/pubs_journals/2022/rmrs_2022_whitman_e001.pdf
[36] https://foresthistory.org/wp-content/uploads/2016/12/2015_GreatFireof1919.pdf
[37] https://www.vanderwell.com/home/company/
[38] https://open.alberta.ca/publications/lesser-slave-lake-regional-2021-forest-management-plan (p.12, 19)

Annual Allowable Cut (AAC) has had to be adjusted in recent years in response to the impact of wildfires on growing stock. Return intervals may shorten in the long-term in correspondence with global warming trends.[39]
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***high***, therefore the RRL is **8 out of 10.** **8**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.** **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 48 out of 100. **48**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* No adjustment. **NN** *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100. **48**

3.7.4 Risk of Infestation

Rationale: Risk of future infestation, including its estimated consequences on feedstock supply, should be calculated into the overall risk profile. Since forest insect populations are influenced by environmental conditions, future changes in climate can be expected to significantly alter the outbreak dynamics of certain forest insect species. In some cases, larger and more frequent insect outbreaks may occur, but in other cases recurring outbreaks may be disrupted or diminished. As climate continues to change, we can expect more situations, particularly at the margins of tree ranges, where sub-optimal conditions for tree growth and reduced tree vigour can lead to outbreaks of forest insects.
Risk Information: The Mountain Pine Beetle (MPB) outbreak of 1997-2014 was largely concentrated in British Columbia. Some lodgepole pine forests located further west (outside of the BDO Zone) were affected. There have been no significant outbreaks of other forest pests common to Alberta, including the spruce budworm and forest tent caterpillar.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* No adjustment. **NN** *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).

[39] https://onlinelibrary.wiley.com/doi/full/10.1002/eco.2403

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

3.7.5 Risk of Hail

Rationale: Hail has negligible impact of forestry biomass but is one of the principal destroyers of agricultural crops in North America.

There is much uncertainty about the effects of anthropogenic climate change on the frequency and severity of extreme weather events like hailstorms and their subsequent economic losses. Some studies indicate a strong positive relationship between hailstorm activity and hailstorm damage, as predicted by minimum temperatures using simple correlations. This relationship suggests that hailstorm damage may increase in the future if global warming leads to further temperature increase.

Risk Information: Not Rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

3.7.6 Risk of Flood

Rationale: Floods can cause catastrophic disruption and delay in feedstock supply. Where there is high risk of flood and thus negative impact to feedstock supply, the BDO Zone rating should account for this risk.

Risk Information: Not Rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

3.7.7 Risk of Drought

Rationale: Droughts can cause significant disruptions to feedstock supplies across entire BDO Zones for extended periods of time, especially in case of agricultural residues and energy crops. Parts of Western Canada are experiencing more frequent and severe droughts, and scientists expect drought to affect new areas across Canada going forward.

Tree species are adapted to specific moisture conditions. Having less water available through drought has a range of negative impacts on the health of forest ecosystems. Direct impacts include reduced growth, increased tree mortality and failure to regenerate. Indirect impacts include reduced ability to defend against insects and disease, and increased fire risk. These impacts can affect the availability of wood fibre for an Issuer.

Risk Information: Droughts occur relatively infrequently in the Lesser Slave Region and have no direct impact on forest growing stock and the forest industry.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**Score** **4**

3.7.8 Risk of Hurricanes, Tornadoes and Strong Winds

Rationale: Hurricanes, tornadoes, and strong winds can destroy timber stands, crops, and feedstock piles. They can also delay forestry and agricultural operations. Hurricanes and tornadoes can indirectly cause temporary shortages of available transportation as available trucking moves to handle higher value disaster related contracts. For example, Katrina cleanup limited availability of live-bottom trailers in the North and South-East of the US for several months as truckers shifted operations to handle more lucrative government contracts.

Although scientists are uncertain whether climate change will lead to an increase in the number of hurricanes, warmer ocean temperatures and higher sea levels are expected to intensify their impacts.

Recent analyses conclude that the strongest hurricanes occurring in some BDO Zones including the North Atlantic have increased in intensity over the past two to three decades.

Risk Information: Not Rated.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**Score** **NR**

3.7.9 Risk of Low Temperatures

Rationale: Low temperatures can cause crop failure, leading to shortages of biomass. Additionally, low temperatures can have adverse impacts on the operations of feedstock processing equipment in Northern BDO Zones.

Risk Information: Forest operations can be put on hold for up to two weeks during the winter months as a result of extreme low temperature events. Generally, operations are temporarily stopped at temperatures <30 degree Celsius to avoid equipment malfunctions. The incidence of <30-degree Celsius days is not expected to increase over time.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

Rationale: Feedstock that is directly subsidized through government programs can pose greater long-term risk than feedstock that is not. Subsidies may be subject to amendment or repeal, sometimes with minimal notice.

NOTE: This risk indicator refers to direct feedstock subsides only; it does not apply to government subsidies that pertain indirectly to the operations of the Issuer such as Loan Guarantees or to the markets for products produced by the Issuer.

Risk Information: There are currently no incentives encouraging the use of forest residue for bioenergy or bio-product applications. Procurers of slash must pay a stumpage fee of approx. $0.25/m^3.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**4**

3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting Pertaining to Biomass

Rationale: Feedstock whose production is directly dependent on local, provincial, or national laws or government regulations can pose greater long-term risk than feedstock that is not, since laws and regulations may be subject to amendment or repeal.

If utilization of biomass requires specific permits (i.e., percentage removal of forest residues or corn stover, allowable cut limits, air emission, storage permits, rights-of-way, overweight permits for trucks, cross-border permitting for shipment of biomass, chain of custody, or certification of sustainability) then likelihood of obtaining such permits and/or complying with permitting requirements should be examined.

Risk Information: Slash burning was banned in Alberta during the winter of 2023-2024 due to above-normal temperatures and dry conditions. This was a precautionary decision made in part due to wildfires. It is possible that slash burning bans could become more common, thereby increasing incentives for physical removal of residue. No other unconventional regulations relevant to biomass supply chains were identified.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

3.8.3 Backlash Against Biomass Development, Procurement or Usage in the Region

Rationale: Public backlash against biomass development in the Issuer BDO Zone can directly impact Issuer's ability to procure, transport, trans-load, store, or utilize feedstock by affecting local policies, regulations, and Issuer's ability to obtain necessary permitting.

Risk Information: Alberta has a pro-industry and pro-forestry culture. There have been no instances in recent years of significant public opposition to the forest industry or bioeconomy. Opposition to Alberta's oil and gas industry likely detracts from public scrutiny of forestry.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**2**
Gross Risk Indicator (GRI)	**Score**
	4

The Gross Risk Indicator (RRL × RRI) is 4 out of 100.
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.

3.8.4 Consent of, and Cooperation with, Indigenous Communities and First Nations

Rationale: Where new project development on or near Indigenous or First Nation land, or where near Indigenous or First Nations exert influence over feedstock producing areas, consent of, and cooperation with, Indigenous communities and First Nations decreases Issuer risk.
Risk Information: First Nations directly govern municipal districts/reserves in the region and work closely with the Municipal District of Lesser Slave River and the Town of Slave Lake. A Tri-Council composed of all council members from the Sawridge First Nation, the Town of Slave Lake, and the Municipal District of Lesser Slave River is the main mechanism for cooperation on infrastructure, emergency response, and related services. First Nations groups are also involved directly in the forest management planning process, providing advice, feedback, and recommendations. Note that legal disputes between First Nations groups and the province are not uncommon.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.** **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 24 out of 100. **24**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* A new proponent interested in establishing a bio-project and supporting supply chains in the region would further reduce risks by actively engaging with First Nations groups independently and through the established mechanisms in the region, including the Tri-Council. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is 25%. **25%**
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 18 out of 100. **18**

3.8.5 Food Security Concerns

Rationale: Despite the fact that any significant correlation between food prices and biofuel production is unclear, claims that biofuel production has driven up food prices, taken food from communities or had a negative impact on land use can fuel public backlash. For example, removal of biomass may raise public concerns relating to food security if Issuer feedstock requires the use of land that would otherwise be used for growing food.

Risk Information: Not rated.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**Score** **NR**

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

Rationale: Public concerns about sustainability of feedstock production can jeopardize biomass feedstock operations. Sustainability certification schemes should be utilized where applicable to ensure that feedstock comes from sustainable sources.

Canada leads all countries with 166 million hectares of certified forests, a figure that is nearly four times more than second place United States at 47 million hectares.

Risk Information: Tenures and forestry on public lands are strictly regulated by the Alberta government to ensure that forest resources are managed in a sustainable and ecologically sound manner. Harvesting must minimize impacts on recreation, tourism, wildlife, protected areas, watersheds, and landscape aesthetics. FMA holders have two years to replant cutovers and have a 14-year liability for reforestation.[40] Further sustainability assurances are provided through third-party certification schemes, which have been applied to ~80% of Alberta's managed forests.[41]	
Raw Risk Likelihood (RRL) The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**Score** **4**

[40] https://www.alberta.ca/forest-tenure-overview

[41] https://open.alberta.ca/dataset/bcec0091-cac0-4257-a8fd-bee57b8a0e6a/resource/1b596266-003c-4ca9-b835-c24bec464613/download/fp-albertas-forest-economy-2023.pdf (p.4)

3.9.2 Risk to Soil Quality

Rationale: Soil sustainability can be defined as management of soil in a way that does not exert any negative or irreparable effects either on the soil itself or any other systems. There is a diversity of approaches to soil sustainability in jurisdictional guidelines for forest biomass harvesting and production. For different feedstock types, there are also different thresholds at which feedstock removal causes significant negative consequences on soil.

Poor soil quality that negatively impacts the long-term sustainability of the feedstock can entail long-term feedstock risk. Sub-optimal soil management can leave exposed soil post residue-harvest which can lead to soil wash-off and soil carbon loss from precipitation and wind. Over-harvesting of biomass also depletes the carbon stock in the soil and creates a negative feedback loop which can degrade the soil and its nutrients.

Risk Information: Not rated.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**Score** **NR**

3.9.3 Risk to Surface and Groundwater

Rationale: Excessive nutrient runoff from biomass feedstock production can accumulate in surface waters and result in algal blooms and hypoxia which can lead to habitat loss for aquatic species higher up the food chain and alter aquatic ecosystem food webs. Damage to aquatic ecosystems can cause social and regulatory backlash. Water intake issues can also increase risk.

Risk Information: Not rated.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**Score** **NR**
Raw Risk Impact (RRI) The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**Score** **NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**Score** **NR**

3.9.4 Water Use

Rationale: Biomass feedstock operations can have significant impacts on the hydrological flux (infiltration, groundwater recharge, interception, and transpiration) of ecosystems. This can lead to water shortages, lower yields, and backlash from regulatory bodies if management plans are not properly instituted.

Risk Information: Not rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

3.9.5 Pesticide Risk to Human and Ecosystem Health

Rationale: Application of pesticides (i.e., herbicides, fungicides, and insecticides) on agricultural and forest landscapes can result in adverse health effects for humans and ecosystems. If pesticide application is required in feedstock production, the impact must be considered in the BDO Zone rating.

Risk Information: Not rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

3.9.6 Risk to Wildlife and Landscape

Rationale: Biomass production and supply chain operations with negative impacts on wildlife and landscape are at a greater long-term risk of encountering project setbacks and disruptions.

Risk Information: Forestry activities are subject to constraints and monitoring relevant to wildlife and landscape. For example, the Lesser Slave Lake Regional Forest Management Plan (FMP) includes special harvesting guidelines ("ground rules") for woodland caribou, grizzly bear, moose, barred owl, and songbird habitat.[42]

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***very low***, therefore the RRL is **2 out of 10.**	**2**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***very low***, therefore the RRI is **2 out of 10.**	**2**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 4 out of 100.	**4**

[42] https://open.alberta.ca/dataset/da99155e-8c52-483e-887d-637871de5a33/resource/011a7827-f90b-4079-a698-e196fbc345e1/download/fpt-timber-harvest-planning-and-ogr-2023-addendum-lesser-slave-lake.pdf

Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 4 out of 100.	**4**

3.9.7 Biomass Classified as Genetically Modified Organism (GMO)

Rationale: There are various risks associated with GMOs such as migration or dispersion across the landscape, which can generate community backlash and create supply chain risk. GMOs can also be heavily regulated. If planning to grow or procure GMO feedstocks, especially purpose-grown energy crops, it is important to understand the risks.

Risk Information: Not rated.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***not relevant***, therefore the RRL is **not rated.**	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***not relevant***, therefore the RRI is **not rated.**	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is NR out of 100.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is NR out of 100.	**NR**

CATEGORY 4.0 FEEDSTOCK SCALE-UP RISK

4.1 Risk Factor: Feedstock Scale-Up

4.1.1 Feedstock Quality at Production Scale

Rationale: The physical and chemical properties of feedstock used in lab, pilot and field testing can fail to be representative of feedstock generated by large-scale operations.

It is important to conduct tests on feedstock representative of that which will be produced by large-scale operations. Failure to adequately test the full range of parameter values can result in severe problems during scale-up.

Risk Information: Forest residue recovery operations can produce feedstock contaminated with dirt, soil, rocks, and other debris when best practices are not followed. Risk of feedstock contamination is expected to increase when crews are inexperienced and under time constraints. Producing 110,000 odt/yr of forest residue would require 4-5 crews, some of which are likely to be inexperienced in initial years. Coupled with the short window for follow-on forest residue recovery operations, risk that delivered forest residue will be contaminated in initial years is increased. We expect that best practices in biomass handling and processing will become routinized over a two-to-three year scale up period.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**

Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 36 out of 100.	**36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

4.1.2 Capacity of Supply Chain Components & Equipment to Scale

Rationale: Scale-up risk increases if supply chain components, or underlying feedstock infrastructure necessary for these components, cannot scale to handle Issuer feedstock requirements and throughput capacity. Capacity to scale should be demonstrated.

Risk Information: Local forestry professionals contacted during outreach could identify only two grinders that regularly operate in the region, mostly in an urban wood waste management capacity. Existing grinding operations occur in forests outside of the BDO Zone, near Peace River, Boyle, and Entwistle. The introduction of new comminution units to regional logging operations would require investments on the part of forestry contractors and would likely require two-to-three years of experience before efficiency maximization.

A single mobile comminution crew operating during the six-month winter harvesting period would have a productivity of 20,000-30,000 odt/yr. This assumes an average grinding productivity of 20 odt/PMH, 180 workdays/year, and 6-8 PMH/day.[43] Therefore, four-to-five dedicated comminution crews would be required to ensure procurement of the rated quantity. Transportation of comminuted forest residue would require 20 dedicated chip trucks.[44] If a market for forest residue developed, the forest industry is likely to respond by purchasing additional units (a trailer costs ~$100,000). There is no scale-up risk associated with the rated quantity of sawmill residues.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***high***, therefore the RRL is **8 out of 10.**	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***high***, therefore the RRI is **8 out of 10.**	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 64 out of 100.	**64**
Mitigation/Notching *RRL Mitigation (25%)* The Woodland Operations Learning Foundation (WOLF) provides training programs for the regional workforce and is composed of representatives of forest product companies with experience in forest residue supply chains (e.g., Mercer International – Peace River). A new venture willing to make modest investments of time and resources in the program would likely increase rates of knowledge transfer and worker recruitment/retention.	**Notch** **25%**

[43] Based on outreach to commercial thinning operator in British Columbia.
[44] Assumes 16 odt payload and 250 working days per year.

RRI Mitigation (Notch) No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100. **48**

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Ind. District

Risk Information: Infrastructure risks were assessed with reference to a 10-acre parcel located in the Mitsue Industrial Park, 60 km east of Kinuso (referred to hereafter as the development site or site). The industrial park is a major hub for the regional forest industry, with three large wood processing facilities with a combined annual wood fibre intake of over 2,000,000 tonnes/yr. The site is zoned for heavy industry and is located in an area of the park with a high density of operating businesses (Map C-2, Appendix C). Formerly the location of the municipal fire department, the site is occupied by building with a large garage that can accommodate multiple vehicles, potable and high-pressure water, office space, and 24/7 residing capabilities.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100. **16**

5.1.2 Ownership of Land

Risk Information: The development site is owned by the Municipal District of Lesser Slave River and is available for purchase or lease. Land prices in the area are approximately $100,000/acre,[45] and are expected to increase at above-normal rates due to a recent surge in oil and gas exploration and development in the region.[46] Property taxes are

[45] Based on outreach to Municipal District of Lesser Slave River

[46] Natural gas production in the Municipal District of Lesser Slave River doubled between 2018 and 2022 (https://regionaldashboard.alberta.ca/region/lesser-slave-river-no-124/natural-gas-production/#/?from=2018&to=2022). See also https://www.mdlsr.ca/your-md/regional-issues/smith-bridge-rebuild/smith-bridge-news/546-investors-rushing-to-secure-drilling-rights

expected to increase in the near-term. Risks of inflated land prices and taxes are moderated to some extent by the willingness of the Municipal District to support the development of new projects.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.** **6**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.** **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* No adjustment. **NN** *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100. **36**

5.1.3 Permitting Description

Risk Information: Development permits are typically issued within 40 days of application acceptance. There are no permitting-related restrictions that would impede project development.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* No adjustment. **NN** *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100. **16**

5.1.4 Environmental Issues

Risk Information: Industrial pollution, air quality, and other environmental issues are heavily regulated by municipal, provincial, and federal orders of government. There are no notable current environmental problems nor is there a history of significant environmental problems in the region. Wastewater treatment infrastructure, including the collection network, treatment facility, and wetland, was upgraded by the Municipal District of Lesser Slave River in 2006. The treatment facility is the first municipal membrane bioreactor in Alberta. With regards to air quality, dust from heavy

industrial traffic is mitigated through the municipal dust control program, which involves application of calcium chloride to roads. Excessive ambient particulate concentrations occur for short durations during the fire season.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100. **16**

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: Natural gas connections are already present on site. Natural gas distribution in Alberta is deregulated. There are over 50 distribution companies operating in the province, most of which operate in urban areas (e.g., Edmonton, Calgary).[47] Businesses located in Mitsue Industrial Park are served by ATCO. The average commodity price of natural gas in Alberta in January of 2024 was $2.63/GJ. Pricing has been relatively volatile since 2010 but has seldom increased above $5/GJ.[48]
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.** **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.** **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL × RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100. **16**

[47] https://ucahelps.alberta.ca/retailers.aspx
[48] https://economicdashboard.alberta.ca/dashboard/natural-gas-price/

5.2.2 Electric Availability

Risk Information: The site is connected to electrical lines with standard voltage for industrial purposes. ATCO is the transmission and distribution operator in the area (one of four large transmission facility owners in the province). Note that a new project seeking to generate and inject electricity into the local grid would require transmission line upgrades subject to regulatory approval. Overall, there is substantial risk associated with the costs that developers must incur to access electricity. In 2023, electricity prices in Alberta were the highest in the country, averaging over 25 cents per kWh.[49] Due to the deregulation of Alberta's electricity sector, electricity prices for commercial facilities are not publicly available but are likely some of the highest in the country.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***high***, therefore the RRL is **8 out of 10.**	**Score** **8**
Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.	**Score** **48**

5.2.3 Water Availability

Risk Information: Potable water is supplied by the Joussard Water Treatment Plant. The facility was upgraded in 2020 to improve the taste of drinking water. Water processed by the facility is derived from Lesser Slave Lake. Water meets all criteria under Guidelines for Canadian Drinking Water Quality. Note that high pressure water is available on site.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score	**Score**

[49] https://www.energyhub.org/electricity-prices/

The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

5.2.4 Waste Disposal

Risk Information: Garbage collection services are provided by GFL Environmental Inc. and Clean Harbors Canada Inc. Both companies offer hazardous waste disposal services. The nearest landfill is Lesser Slave Lake Regional Waste, located within a 35 km drive of Kinuso and Mitsue Industrial Park.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

5.2.5 Internet Availability

Risk Information: Fibre optic service is available in the park (provider: Bell). Starlink is also common in the area for off-site internet.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: The primary roadway in the region is the Alberta Provincial Highway No.2, which provides the communities and businesses in Slave Lake, High Prairie, and surrounding area with access to Edmonton and Calgary. The section of the highway located in the BDO Zone is undivided. Many secondary roads adjacent to the Mitsue Industrial Park are not paved (Map C-3, Appendix C).[50] The MD of Lesser Slave River is actively promoting the park as an economic development area while petitioning the province to improve road infrastructure (particularly the secondary highways connecting the park to Highway 2).

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is **36** out of 100.	**36**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 36 out of 100.	**36**

5.3.2 Rail Access

Risk Information: A rail spur is available within 100 meters from the industrial site on the properties of Vanderwell Contractors and West Fraser (Map C-4, Appendix C). The main rail line extends to Great Slave Lake in the north and to Edmonton in the south, from which it branches west, south, and east for intra- and inter-national service. Freight services are provided by Canadian National and Canadian Pacific.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**

[50] https://mdmatters.ca/mitsue-industrial/

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

5.3.3 Airport Access

Risk Information: The Slave Lake Airport offers charter services only. Commercial flights services are offered at Grand Prairie Airport (275 km from Kinuso) and the Edmonton International Airport (325 km from Kinuso). Risk likelihood is increased to medium due to the long commute distances required if commercial airlines are used by project proponents. Risk impact is moderated by the relatively high availability of charter flights to Slave Lake, frequently used by developers in the oil and gas and forestry industries.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**6**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**24**

5.3.4 Water Freight Access

Risk Information: There is no water freight access in Alberta. The forest industry has been shipping their products using trucks and railways to the domestic, regional, and international markets.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**4**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**16**

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: The Slave Lake Healthcare Centre serves the over 7,000 people residing in the Municipal District of Lesser Slave River and the Town of Slave Lake. Air ambulance is available and emergency response services are well trained and experienced due to recent wildfires.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

5.4.2 Education (Schools)

Risk Information: Educational institutions in the region include the public school system (Kindergarten to grade 12) and the Northern Lakes College network of campuses. The main Northern Lakes College campus is located in the Town of Slave Lake. Programs available through the College are business-oriented and include administrative, accounting, and financial specializations. Technical programs including GIS and trades relevant to oil, gas, and forestry are also available. Small Christian private schools are available in Grand Prairie. The nearest secular private schools and universities are located over 250 km away in Edmonton.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

5.4.3 Local Transportation

Risk Information: There are no public transit options in the area. Many larger manufacturing businesses in the Mitsue Industrial Park arrange for workers to be transported from a central site. Taxi service is available.

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

5.4.4 Public Safety (Local)

Risk Information: In addition to the Royal Canadian Mounted Police (RCMP), the Municipal District of Lesser Slave River employs two full-time peace officers with mandate to respond to emergencies and enforce bylaws. Wildfires also present a risk to public safety. Municipalities and reserves within the BDO Zone actively manage fuel loads under the Alberta FireSmart program. The Municipal District of Lesser Slave River, for example, has dedicated forest firefighters, a helicopter, and mechanical thinning crews.[51] Other public safety measures offered in the region include a crisis notification system (e.g., for fires and flooding).

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***low***, therefore the RRL is **4 out of 10.**	**Score** **4**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 16 out of 100.	**Score** **16**

[51] https://www.mdlsr.ca/

5.4.5 Housing/Cost of Living

Risk Information: Housing supply is insufficient for demand, which is rising rapidly in response to oil and gas industry development. Home purchase and rental costs reflect this: for example, single bedroom units typically costs >$2,000/month. Other towns in the area with housing capacity (e.g., High Prairie and Westlock) are not located within commuting distance. While the Town of Slave Lake and Municipal District of Lesser Slave River have an interest in supporting residential construction projects, there are few new developments in these areas.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***high***, therefore the RRL is **8 out of 10.**	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**48**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.	**48**

5.5 Risk Factor: Labour

5.5.1 Workforce

Risk Information: The regional workforce is specialized in the resource industries, including oil and gas development and forestry. Approximately 20% of workers living in the Town of Slave Lake are classified under the "trades, transport and equipment operators and related occupations" National Occupation Classification.[52] Regional workers are a combination of residing and transient. The unemployment rate estimate under the most recent census was slightly lower than the provincial average (10% vs. 11%).

The regional forestry workforce is well established. In the Mitsue Industrial Park alone, there are ~600 permanent full-time employees.[53] Recruitment of new workers remains challenging due to the remoteness of the region. Relocation, housing, and other incentives are often required to attract and retain employees. Labour market competition is also enhanced due to the oil and gas industry, which is expected to grow in the next decades.

The continued growth of the regional oil and gas industry creates workforce risks for new bioeconomy projects. Active labour force recruitment will likely be required by new entrants to the region.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed ***high***, therefore the RRL is **8 out of 10.**	**8**

[52] https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=Slave%20Lake&DGUIDlist=2021S05100764&GENDERlist=1,2,3&STATISTIClist=1&HEADERlist=0
[53] https://mdmatters.ca/mitsue-industrial/

Raw Risk Impact (RRI) The risk impact is deemed ***medium***, therefore the RRI is **6 out of 10.**	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 48 out of 100.	**Score** **48**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 48 out of 100.	**Score** **48**

5.5.2 Labour Costs

Risk Information: Labour costs are higher than average in the region owing to the inflated costs of goods and services (located in the northern region of Alberta). Provincial tax breaks available for residents are not sufficient to counter the need for elevated wages to match the cost of living. The median household income in Slave Lake is $111,000, compared to the provincial average of $96,000.[54]

Raw Risk Likelihood (RRL) The risk likelihood is deemed ***medium***, therefore the RRL is **6 out of 10.**	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed ***low***, therefore the RRI is **4 out of 10.**	**Score** **4**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL × RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch × RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) × GRI Score) is 24 out of 100.	**Score** **24**

[54] https://www.point2homes.com/CA/Demographics/AB/Slave-Lake-Demographics.html#:~:text=The%20median%20household%20income%20in%20Slave%20Lake%20is%20%24111%2C000%2C%20while,sits%20at%20%2495%2C000%20per%20year.

APPENDIX C: TABLES AND FIGURES

Table C-1. 2023 FRIAA FireSmart projects, by area treated by mechanical thinning[55]

Location	Veg/Fuel Mgmt Area (ha)
Beaver First Nation Boyer 164	25
Bigstone Cree Nation	45
Chipewyan Prairie First Nation	12
City of Grande Prairie	17
Dene Tha' First Nation	12
East Prairie Metis Settlement	20
Gift Lake Metis Settlement	21
Kananaskis Improvement District	4
Little Red River Cree Nation	10
Loon River First Nation #235	10
Municipal District of Bonnyville	16
Municipal District of Opportunity No.17	83
O'Chiese First Nation Indian Reserve No.203	23
Paddle Prairie Metis Settlement	11
Peerless Trout First Nation	24
Regional Municipality of Wood Buffalo	30
Stoney Nakoda First Nation	36
Sucker Creek First Nation	20
Summer Village of Walparous	13
Sunchild First Nation	45
Town of Banff	13
Town of Canmore	25
Town of Cochrane	9
Town of Edson	6
Town of Fox Creek	8
Town of Swan Hills	26
Town of Whitecourt	25
Whitefish Lake First Nation #459	22
TOTAL	**602**

[55] https://friaa.ab.ca/programs/friaa-firesmart/

Table C-2. Provincial harvesting and AAC data, 2012-2021 (Government of Alberta, 2021)[56]

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Harvest volume (million m3)	20.9	20.6	21.3	25.5	23.3	25.3	24.9	22.8	26.3
AAC volume (million m3)	30.3	31.2	32.4	32.4	32.1	31.6	31.5	29.6	29.5

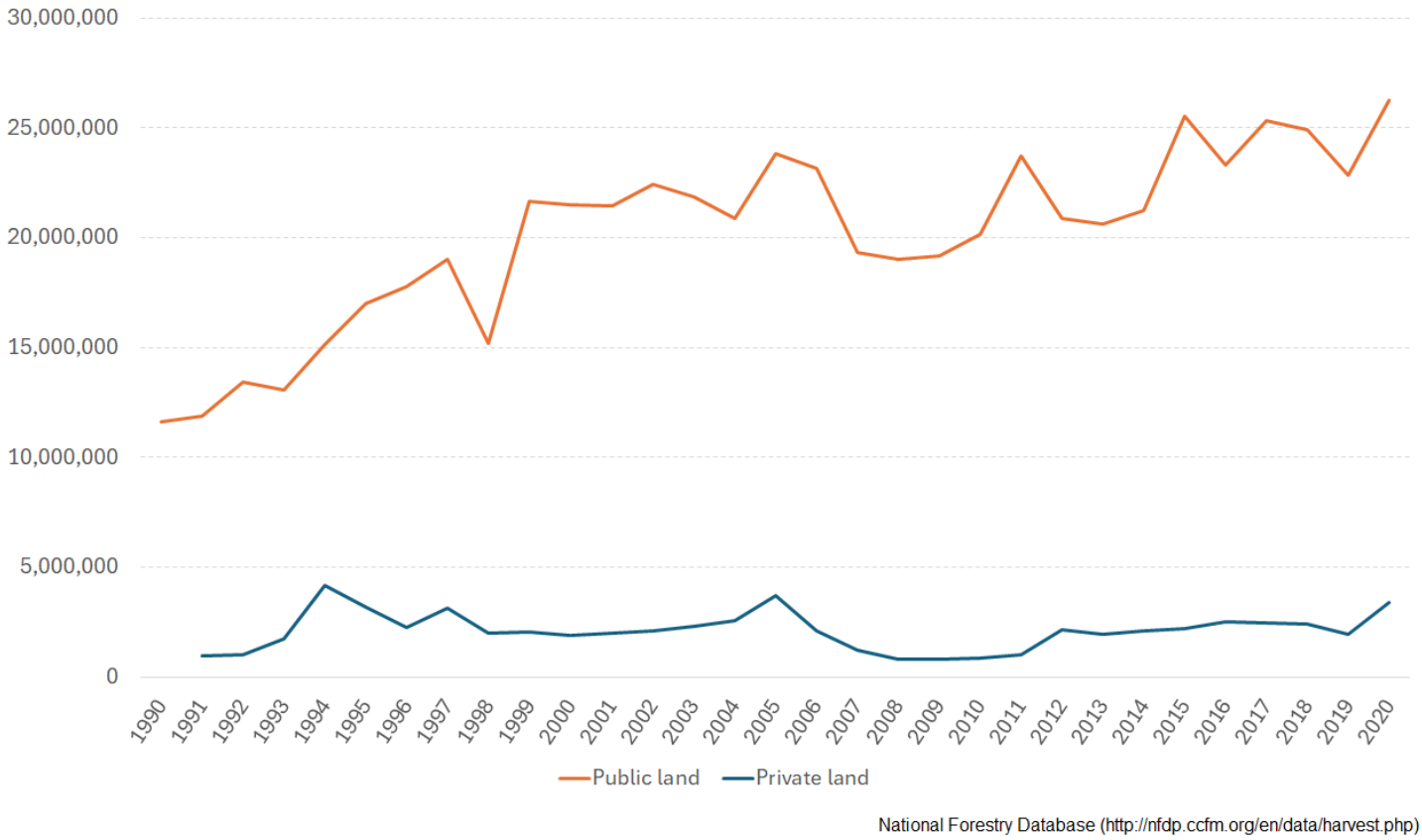
Table C-3. Current Forest Management Agreements in lands that overlap with the BDO Zone[57]

FMA number / FMUs	Forest product companies	FMA duration	Year of original agreement	Total size (hectares)	Details
FMA9700036 / S24	Vanderwell Contractors (1971) Ltd.	2014-2034	1997	84,000	Dimensional lumber and pellets
FMA9000028 / S20	West Fraser Mills Ltd. (Slave Lake) -Millar Western Forest Products Ltd. -Vanderwell Contractors (1971) Ltd.	2012-2033	1990	637,000	Chemi-thermomechanical pulp
FMA0600043 / S16, 17, S19, S20, S21, S24	Tolko Industries Ltd. / Vanderwell Contractors (1971) Ltd. / West Fraser Mills Ltd.	2019-2039	2006	702,062	Tolko – EWP Vanderwell – Dimensional lumber and pellets West Fraser Mills Ltd. – Sawmill and veneer mill (Slave Lake), plywood mill (Edmonton)
FMA7500020 / W14	Blue Ridge Lumber Inc. -ANC Timber Ltd. -Millar Western Forest Products Ltd.	2008-2028	1975	661,085	Dimensional lumber and medium-density fibreboard
FMA9100029 / L2, S18, S23	Alberta-Pacific Forest Industries Inc. -Alberta Forest Industries Ltd. -Ed Bobocel Lumber (1993) Ltd. -Kee Tas Kee Now Sawmill Ltd. -Northland Forest Products Ltd. -S-11 Logging Company Ltd. -Vanderwell Contractors (1971) Ltd. -West Fraser Mills Ltd.	2011-2032	1991	6,371,308	Bleached kraft pulp

[56] FIND REFERENCE
[57] https://www.alberta.ca/forest-management-agreements

FMA9700033 / S19	Tolko Industries Ltd. (High Prairie) -West Fraser Mills Ltd.	2021-2041	1994	254,507	OSB
FMA9700034 / W16	Canfor (Whitecourt) Forest Products Ltd. -Millar Western Forest Products Ltd. -Weyerhaeuser Company Limited	2014-2034	1997	440,431	Dimensional lumber
Crown Forest Management Plan / PO5, S26	--	2015-2025	--	26,030	--

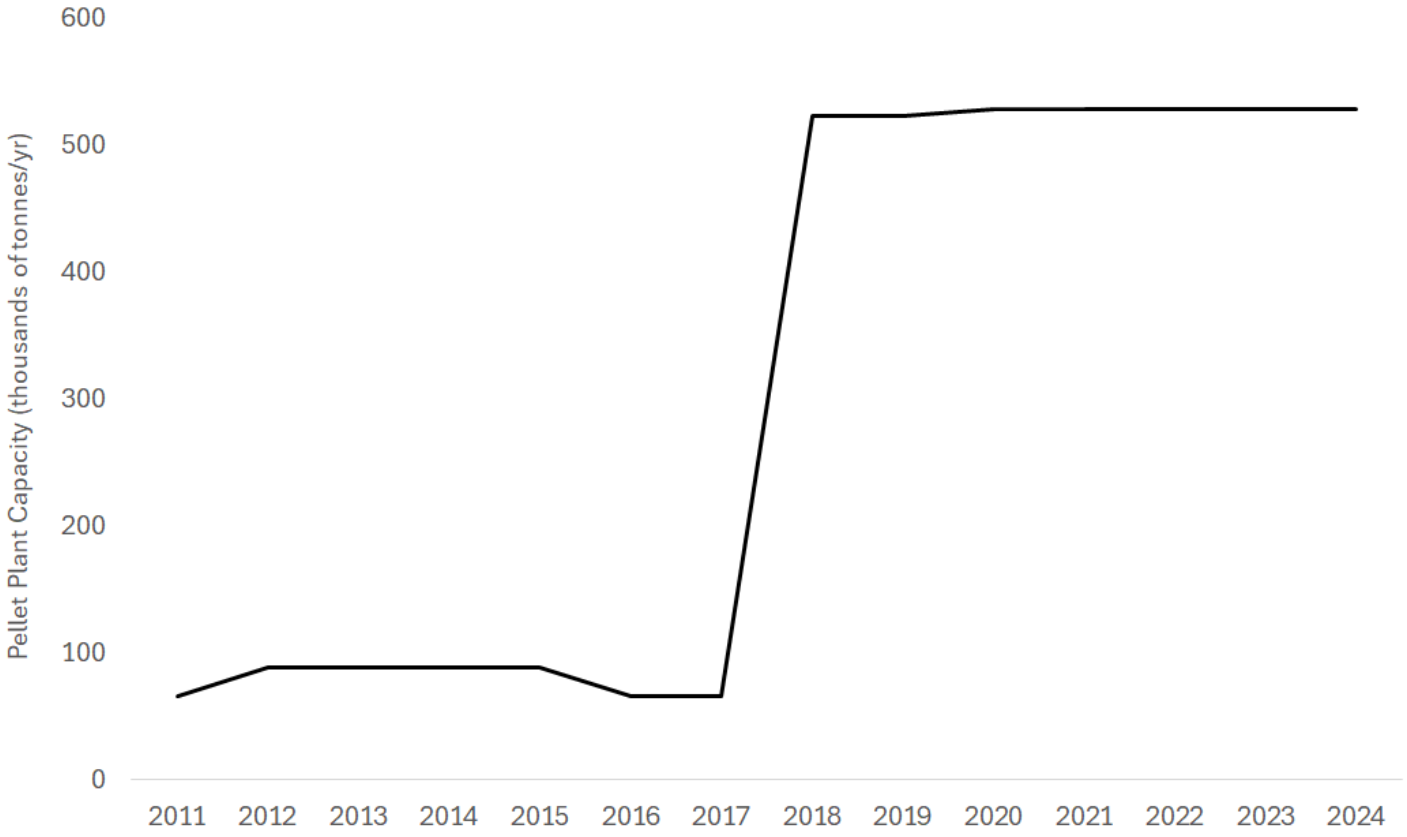
Figure C-1. Wood supply from public and private lands in Alberta, 1990-2020[58]



National Forestry Database (http://nfdp.ccfm.org/en/data/harvest.php)

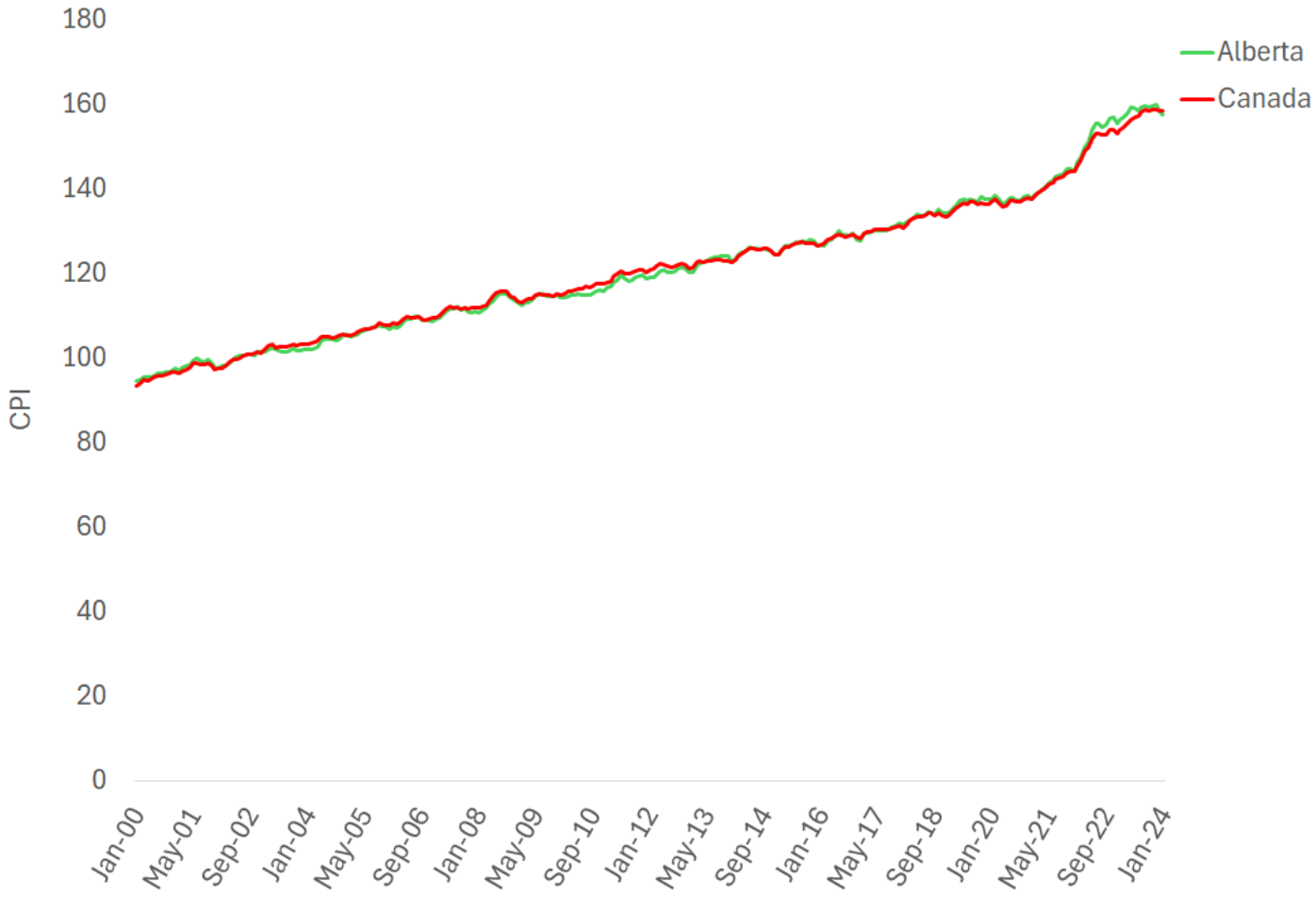
[58] National Forestry Database (http://nfdp.ccfm.org/en/data/harvest.php)

Figure C-2. Pellet mill capacity in the Competition Zone, 2011-2024[59]



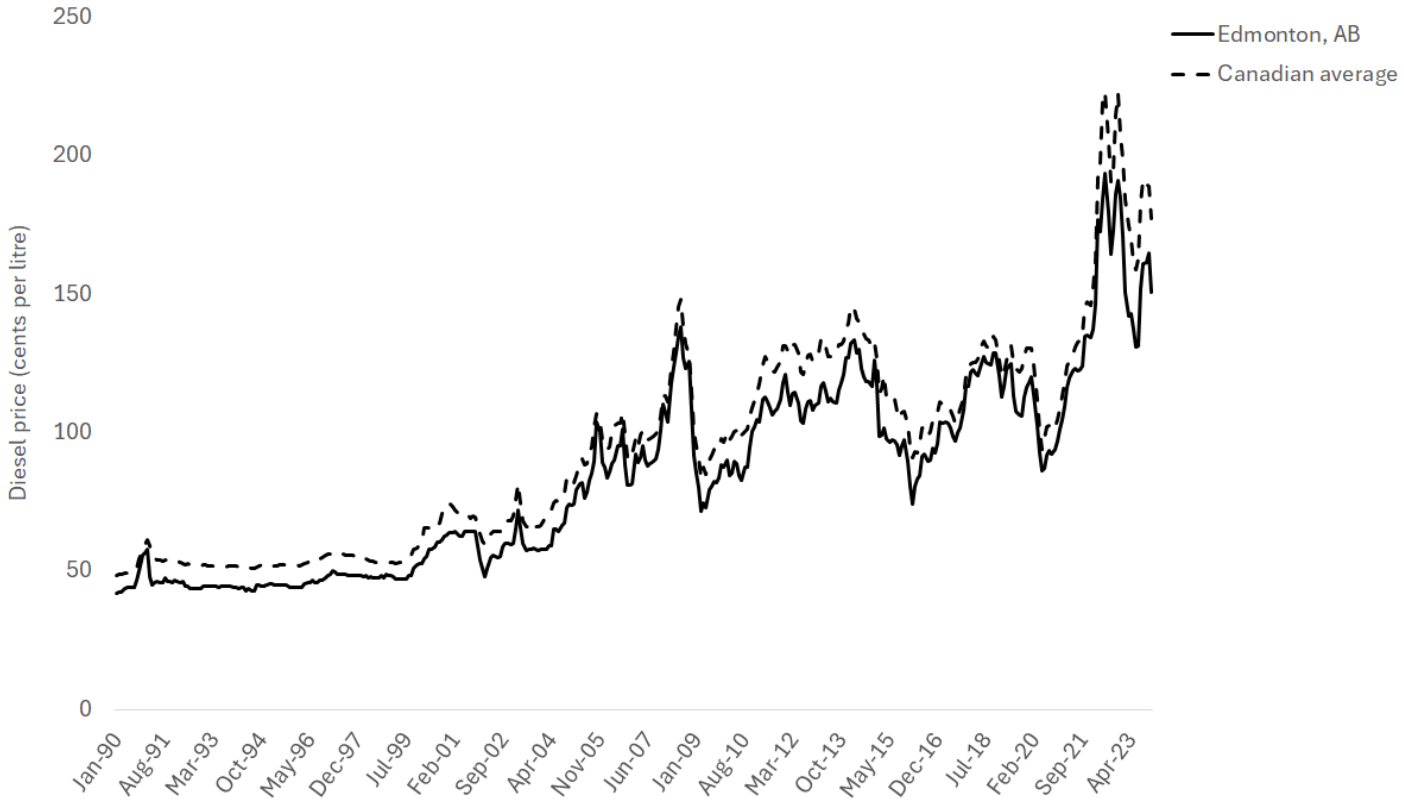
[59] FORISK

Figure C-3. Comparison of Alberta and Canada CPI, 2020-2024[60]



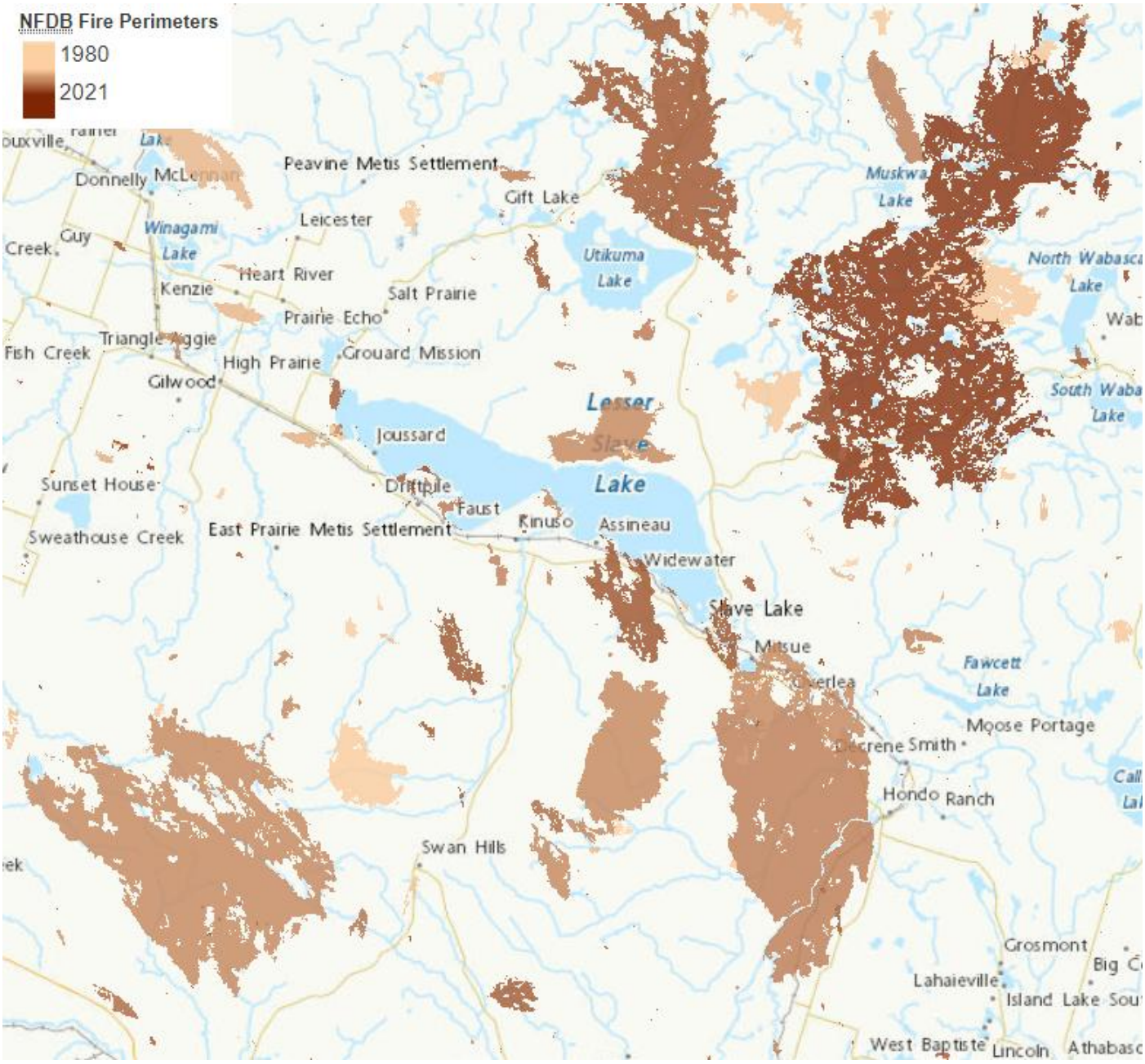
[60] https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?

Figure C-4. Diesel prices in Edmonton, AB in comparison to the Canadian average, 1990-2023[61]



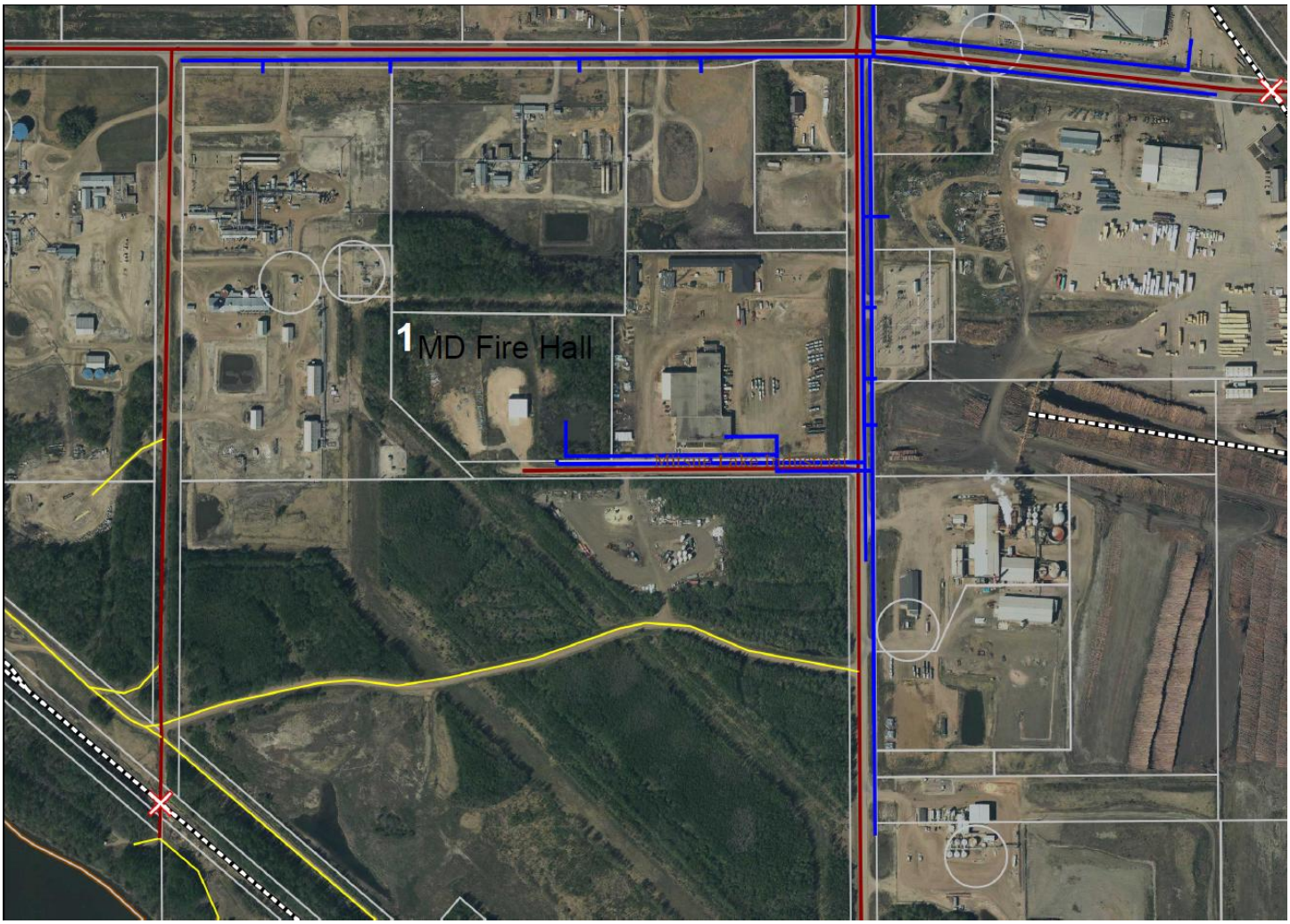
[61] https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000101

Map C-1. Fire perimeters in the Lesser Slave region, 1980-2021[62]



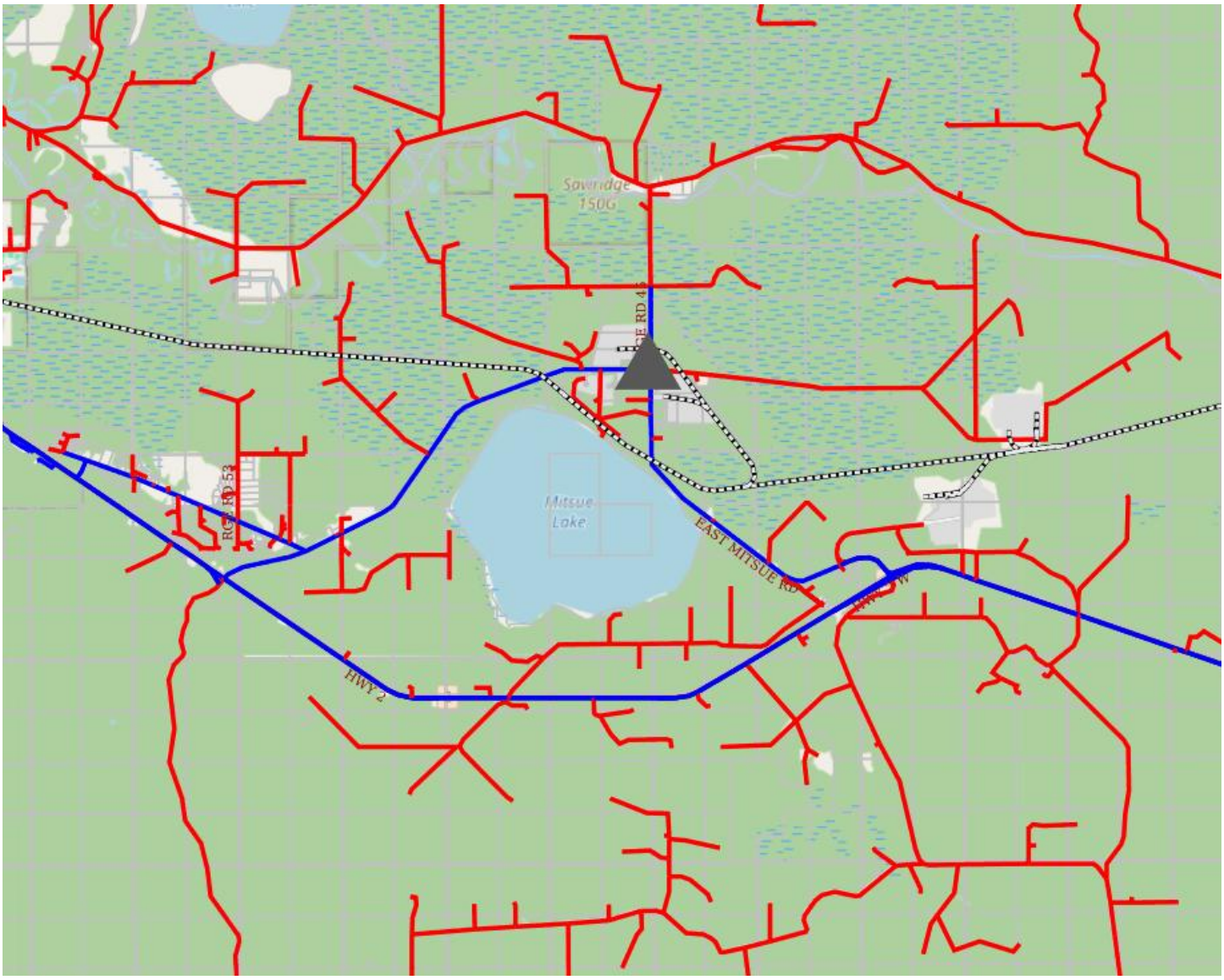
[62] https://cwfis.cfs.nrcan.gc.ca/interactive-map

Map C-2. Location of evaluated industrial site [1] within the Mitsue Industrial Park



*Blue lines indicate location of water infrastructure; Red line indicate location of sewer infrastructure

Map C-3. Paved (blue) and gravel (red) roads in the vicinity of Mitsue Industrial Park (grey triangle)[63]



[63] https://app.munisight.com/MDofLesserSlaveRiver/Content/Server/Login.aspx?ReturnUrl=/MDofLesserSlaveRiver/

Map C-4. Location of rail spur (dark red) in Mitsue Industrial Park and main rail line (orange)[64]



[64] https://www.openrailwaymap.org/

APPENDIX E: LEGAL DISCLAIMER

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