VEGREVILLE, AB

Biofuel Development Opportunity Zone

RATING GRADE: 'A'

Date of Issue: July 23, 2024

A
High Quality

Rating Parameters:

Category	Rated Quantity	Delivered Price	BDO Zone Size
Wheat Straw	**455,000 bdt/yr**	**$115-$140/bdt**	**120-km drive distance from Vegreville, AB**

BDO ZONE ASSETS

- Long history of wheat production, supported by experienced growers with expertise in wheat straw harvesting and collection.
- Limited competition for wheat straw.
- Wheat growers' support and willingness to participate in commercial biomass projects due to high wheat straw yield.
- Existing, underutilized fleet of harvest and transportation equipment presents an operational starting point.

BDO ZONE LIABILITIES

- Short and variable straw harvest window increases operational and feedstock quality risks.
- Most baling equipment owned by livestock producers with little incentive to participate in supply chain.
- Existing harvest fleet will likely need to be upgraded to meet quality specifications of future biomass projects.
- Greenfield industrial site requires upgrading major infrastructures such as electricity and natural gas.

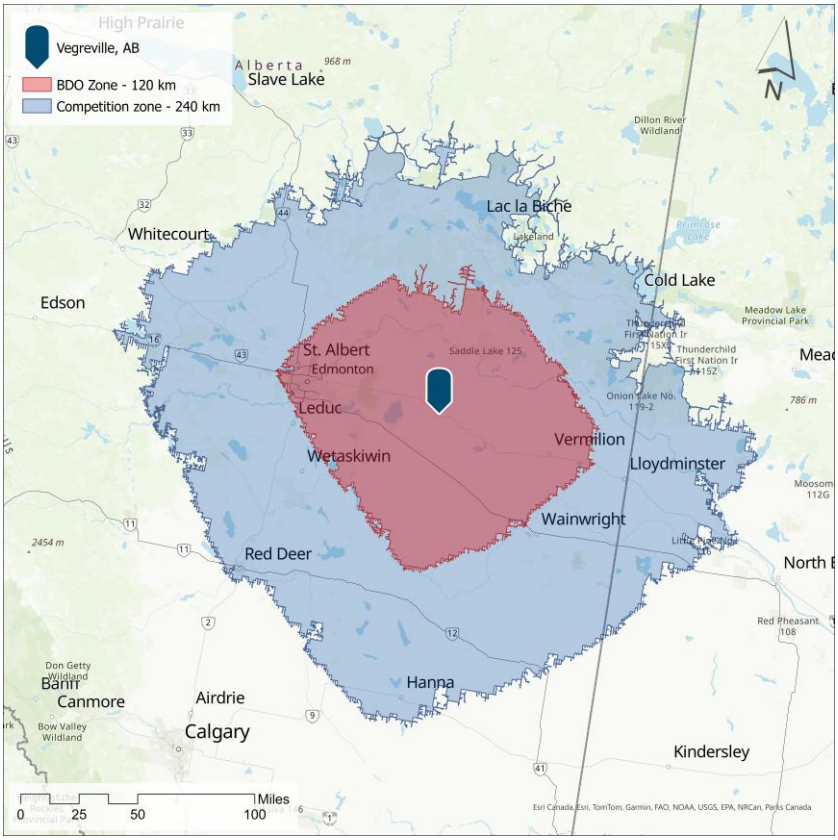
RATING GRADE

The Vegreville, AB, Biofuel Development Opportunity Zone, is rated 'A', or 'low' 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).

'A' ratings denote high prospective viability of Feedstock Supply and Infrastructure and low expectations of default risk in the Zone. Capacity to support new biobased plant operations is considered strong. However, this capacity may be vulnerable to the short and unpredictable harvest season for wheat straw due to weather, the inability of current equipment infrastructure to meet the required quality and quantity specifications for future biomass projects, and inadequate supporting infrastructure at the industrial site.

VEGREVILLE, ALBERTA BDO ZONE



BD OZ THE BIOFUEL DEVELOPMENT OPPORTUNITY ZONE INITIATIVE

ANALYST NOTES

In this risk rating assessment, we determined the availability and pricing of wheat straw. The estimated rated quantity for future biomass projects is the low-risk quantity after considering current competition, supply chain constraints (e.g., operational, accessibility, and market dynamics), and data/model uncertainty. The rated pricing is the expected price that future biomass projects are likely to pay to secure the rated quantity.

We estimate that the low-risk availability of wheat straw in the BDO Zone is 455,000 bdt/year, about 13% of the total wheat straw generated (3.4 million bdt/year). Operational and sustainability constraints applied in the availability calculations are the main factors affecting the difference in quantity. The calculated delivered price range of wheat straw bales is between $115-$140/bdt.

In addition to evaluating the rated quantity and pricing, this report assessed the BDO Zone's suitability for accommodating future biomass projects by considering 10 supplier risks, 10 competition risks, 46 supply chain risks, 2 feedstock scale-up risks, and 20 infrastructure risks. Two high-risk indicators were identified in relation to short harvest windows and seasonal variability of wheat straw production, influenced by weather patterns that can increase precipitation, delay field operations, and potentially affect bale quality. Additionally, 27 medium-risk indicators were identified, primarily related to infrastructure and supply chain scale-up. Most low-risk indicators are associated with the historically stable production of wheat with minimal long-term weather risk and lack of competition for this biomass, as there are no large-scale operations demanding wheat straw bales within the BDO Zone. A summary of main assets (very low/low risks) and liability (medium/high risks) are discussed in the following sections.

BDO ZONE ASSETS

The BDO Zone is a traditional agricultural region with a long history of wheat cultivation. It consists of predominantly fertile black soil, greatly influencing farmer participation in the wheat straw supply. Higher yields correlate with increased willingness to engage in the supply chain. Consequently, this abundance of potential sources of wheat straw suppliers creates positive redundancy in the feedstock supply.

Baling is a known practice in the BDO Zone, even though it is currently performed mainly by livestock producers. However, farmers are willing to supply bales if offered the right pricing.

The existing wheat straw harvest and transportation equipment are favourable starting points for scaling up the supply chain. Given the limited use of the current baler fleet, increasing the demand for straw could potentially enhance its utilization in the BDO Zone.

BDO ZONE LIABILITIES

Precipitation can hinder field operations and increase bale moisture, leading to quality issues and potential deterioration depending on storage conditions. Thus, the short and uncertain harvesting window of 3-5 weeks following the grain harvest creates feedstock quality and supply chain scale-up challenges that require logistical planning in collaboration with a large number of farmers.

The existing equipment infrastructure caters to the requirements of livestock producers and may serve as a foundation for scaling up the supply chain. If a new entrant relies on the underutilized capacity within this infrastructure to start, it is likely to be quickly utilized in large-scale industrial projects. This scenario still necessitates investment in additional balers and operational crews to meet the demand of a commercial-scale biomass project and meet quantity and quality specifications.

INFRASTRUCTURE PROFILE

The proposed industrial site is located at the southeast edge of Vegreville in a 72-acre industrial park. The park is made up of lots ranging from 1 to 22 acres and is zoned as M2—Heavy Industrial District. The site is a greenfield with road access and a treated water supply. However, the natural gas mainline and 3-phase electrical connection are not yet available but are scheduled for installation in 2024.

The site is adjacent to a CN rail line with no spur into the lots. Vegreville is 22 kilometres west of Highway 36, a major north-south corridor connecting the U.S. and Mexican markets. Outreach has found that Provincial and

local highways and roads are in good condition and do not present logistical risk.

All lots within the industrial park are owned by the Town of Vegreville and are available for purchase at $50,000 per acre. The town's permitting timelines are faster than the provincial averages, given that the proper documentation is submitted.

SCORING & RATING METHODOLOGY

In assessing the biomass supply chain risk for the Biofuel 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 bone dry tonnes per year (bdt/yr), while feedstock costs are expressed in Canadian dollars (CAD). Maximum transport distance is based on a 120-km driving distance from the centre point (Vegreville, 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 then calculated as the product of the RRL and the RRI scores. For example, if the 'Competitor Price and Price Sensitivity' is scored at an RRL of 2 and an RRI of 8, then the GRI for this risk indicator is 2 X 8 = 16.

If the analyst deems that a typical bio-based project could implement economically reasonable measures or best practices that mitigate the likelihood (RRL), 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 and Infrastructure Indicators. The BDO Zone score for Vegreville, AB, is ***20.85 out of 100, resulting in an 'A' designation.***

All scoring and rationale for each Risk Indicator are provided in Section D.

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SECTION A: RISK INDICATOR SUMMARY

Figure A-1. Risk Indicators (Sorted by Risk Level)

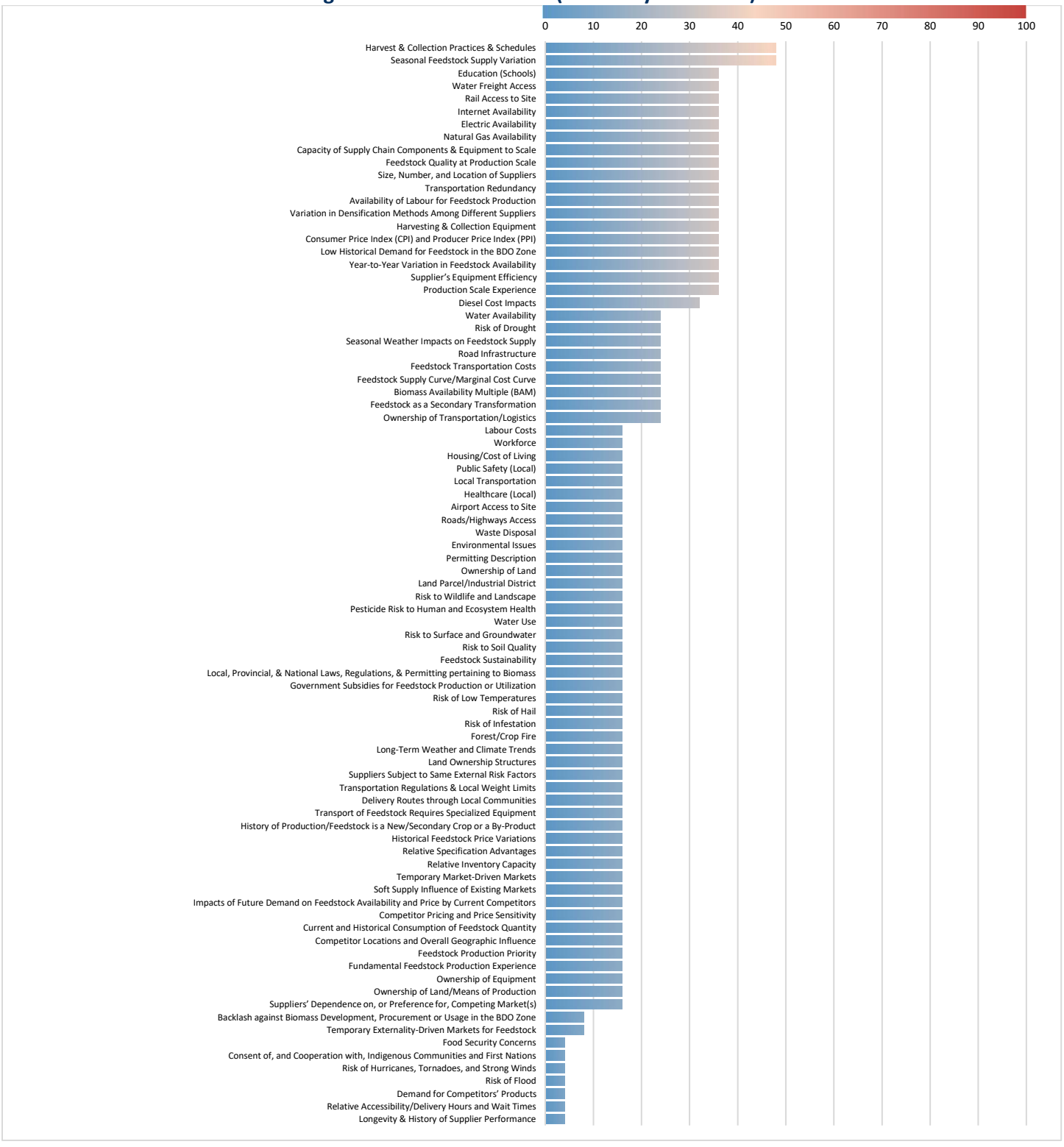


Table A-1. Risk Indicators and Associated Scores

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 Risk Factor: Credit-Worthiness/Future Solvency of Suppliers					
1.1.1 Longevity & History of Supplier Performance	2	2	4	NN	4
1.2 Risk Factor: Conflicts of Interest/Vested Interest with Competing Market(s)					
1.2.1 Suppliers' Dependence on, or Preference for, Competing Market(s)	4	4	16	NN	16
1.3 Risk Factor: Supplier Control Over Production and Transportation					
1.3.1 Ownership of Land/Means of Production	4	4	16	NN	16
1.3.2 Ownership of Equipment	4	4	16	NN	16
1.3.3 Ownership of Transportation/Logistics	4	6	24	NN	24
1.3.4 Feedstock as a Secondary Transformation	4	6	24	NN	24
1.4 Risk Factor: Supplier Experience					
1.4.1 Fundamental Feedstock Production Experience	4	4	16	NN	16
1.4.2 Production Scale Experience	6	6	36	NN	36
1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity					
1.5.1 Supplier's Equipment Efficiency	6	6	36	NN	36
1.6 Risk Factor: Supplier Motivation					
1.6.1 Feedstock Production Priority	4	4	16	NN	16
Category 2.0: Competitor Risk					
2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets					
2.1.1 Competitor Locations and Overall Geographic Influence	4	4	16	NN	16
2.1.2 Current and Historical Consumption of Feedstock Quantity	4	4	16	NN	16
2.1.3 Competitor Pricing and Price Sensitivity	4	4	16	NN	16
2.1.4 Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	4	4	16	NN	16
2.1.5 Soft Supply Influence of Existing Markets	4	4	16	NN	16
2.1.6 Temporary Market-Driven Markets	4	4	16	NN	16
2.2 Risk Factor: Specific Competitors' Competitive Advantage					
2.2.1 Relative Inventory Capacity	4	4	16	NN	16
2.2.2 Relative Accessibility/Delivery Hours and Wait Times	2	2	4	NN	4
2.2.3 Relative Specification Advantages	4	4	16	NN	16
2.2.4 Demand for Competitors' Products	2	2	4	NN	4
Category 3.0: Supply Chain Risk					
3.1 Risk Factor: Feedstock Availability					
3.1.1 Biomass Availability Multiple (BAM)	4	6	24	NN	24
3.1.2 Feedstock Supply Curve/Marginal Cost Curve	4	6	24	NN	24
3.1.3 Seasonal Feedstock Supply Variation	6	8	48	NN	48
3.1.4 Year-to-Year Variation in Feedstock Availability	6	6	36	NN	36
3.2 Risk Factor: Historical Issues					
3.2.1 Historical Feedstock Price Variations	4	4	16	NN	16
3.2.2 Low Historical Demand for Feedstock in the BDO Zone	6	6	36	NN	36
3.2.3 History of Production/Feedstock is a New/Secondary Crop or a By-Product	4	4	16	NN	16
3.3 Risk Factor: Non-Weather Based Externalities					
3.3.1 Consumer Price Index (CPI) and Producer Price Index (PPI)	6	6	36	NN	36
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	2	4	8	NN	8
3.4 Risk Factor: Risks Related to Feedstock Production, Harvest, and Collection					
3.4.1 Harvest & Collection Practices & Schedules	6	8	48	NN	48
3.4.2 Harvesting & Collection Equipment	6	6	36	NN	36
3.4.3 Variation in Densification Methods Among Different Suppliers	6	6	36	NN	36
3.4.4 Availability of Labor for Feedstock Production	6	6	36	NN	36
3.5 Risk Factor: Transportation					
3.5.1 Feedstock Transportation Costs	4	6	24	NN	24
3.5.2 Diesel Cost Impacts	8	4	32	NN	32
3.5.3 Transport of Feedstock Requires Specialized Equipment	4	4	16	NN	16
3.5.4 Delivery Routes through Local Communities	4	4	16	NN	16
3.5.5 Transportation Regulations & Local Weight Limits	4	4	16	NN	16
3.5.6 Road Infrastructure	4	6	24	NN	24
3.5.7 Transportation Redundancy	6	6	36	NN	36
3.6 Risk Factor: Supply Chain Resiliency					

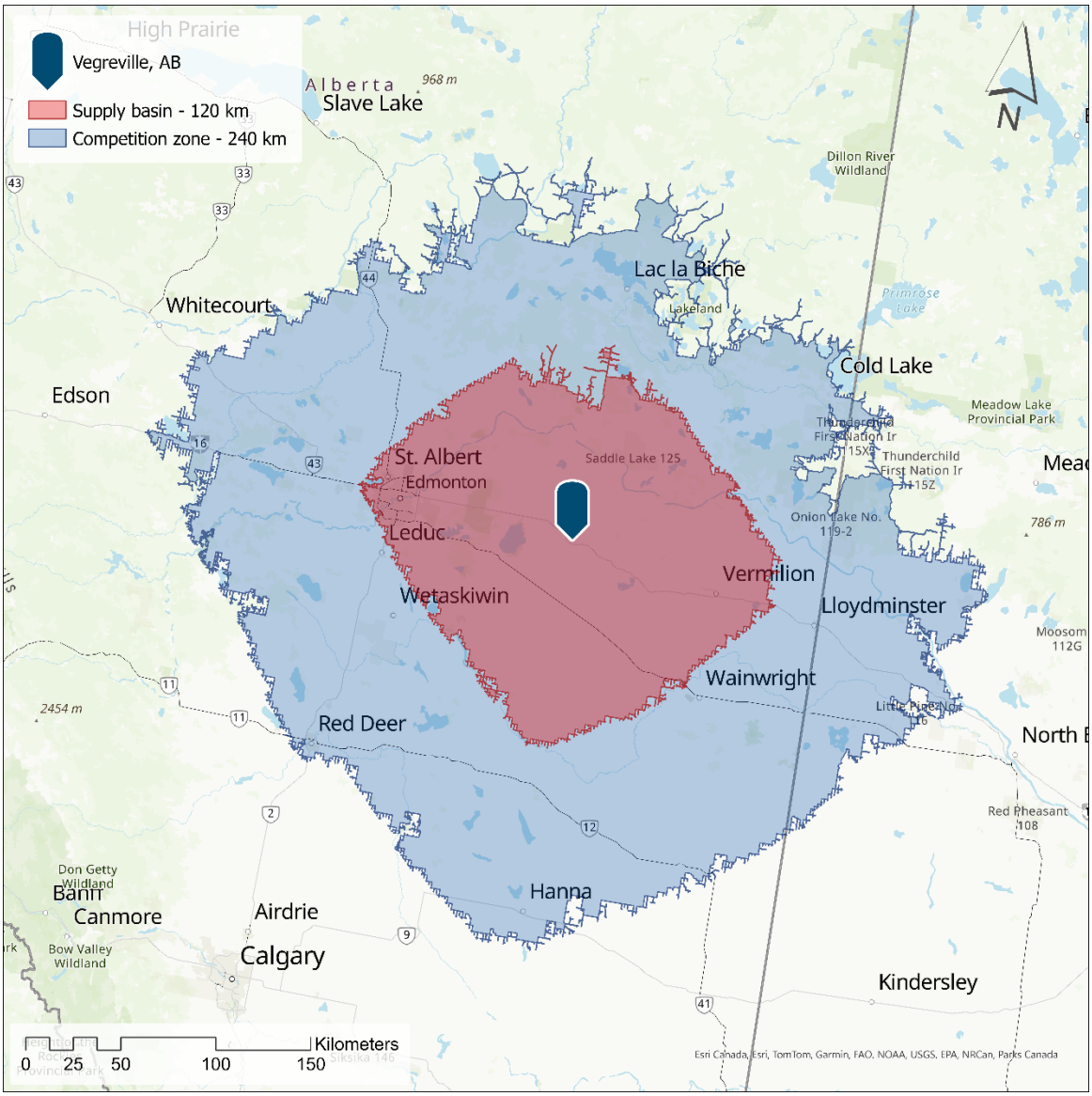
3.6.1 Size, Number, and Location of Suppliers	6	6	36	NN	36
3.6.2 Suppliers Subject to Same External Risk Factors	4	4	16	NN	16
3.6.3 Land Ownership Structures	4	4	16	NN	16
3.7 Risk Factor: Climate and Natural Risks					
3.7.1 Seasonal Weather Impacts on Feedstock Supply	6	4	24	NN	24
3.7.2 Long-Term Weather and Climate Trends	4	4	16	NN	16
3.7.3 Forest/Crop Fire	4	4	16	NN	16
3.7.4 Risk of Infestation	4	4	16	NN	16
3.7.5 Risk of Hail	4	4	16	NN	16
3.7.6 Risk of Flood	2	2	4	NN	4
3.7.7 Risk of Drought	4	6	24	NN	24
3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds	2	2	4	NN	4
3.7.9 Risk of Low Temperatures	4	4	16	NN	16
3.8 Risk Factor: Political and Social					
3.8.1 Government Subsidies for Feedstock Production or Utilization	4	4	16	NN	16
3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting pertaining to Biomass	4	4	16	NN	16
3.8.3 Backlash against Biomass Development, Procurement or Usage in the BDO Zone	4	2	8	NN	8
3.8.4 Consent of, and Cooperation with, Indigenous Communities and First Nations	2	2	4	NN	4
3.8.5 Food Security Concerns	2	2	4	NN	4
3.9 Risk Factor: Sustainability and Environmental Concern					
3.9.1 Feedstock Sustainability	4	4	16	NN	16
3.9.2 Risk to Soil Quality	4	4	16	NN	16
3.9.3 Risk to Surface and Groundwater	4	4	16	NN	16
3.9.4 Water Use	4	4	16	NN	16
3.9.5 Pesticide Risk to Human and Ecosystem Health	4	4	16	NN	16
3.9.6 Risk to Wildlife and Landscape	4	4	16	NN	16
3.9.7 Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
Category 4.0: Feedstock Scale-up Risk					
4.1 Risk Factor: Feedstock Scale-Up					
4.1.1 Feedstock Quality at Production Scale	6	6	36	NN	36
4.1.2 Capacity of Supply Chain Components & Equipment to Scale	6	6	36	NN	36
Category 5.0: Infrastructure					
5.1 Risk Factor: Physical Infrastructure					
5.1.1 Land Parcel/Industrial District	4	4	16	NN	16
5.1.2 Ownership of Land	4	4	16	NN	16
5.1.3 Permitting Description	4	4	16	NN	16
5.1.4 Environmental Issues	4	4	16	NN	16
5.2 Risk Factor: Utilities					
5.2.1 Natural Gas Availability	6	6	36	NN	36
5.2.2 Electric Availability	6	6	36	NN	36
5.2.3 Water Availability	4	6	24	NN	24
5.2.4 Waste Disposal	4	4	16	NN	16
5.2.5 Internet Availability	6	6	36	NN	36
5.3 Risk Factor: Transportation/Logistics					
5.3.1 Roads/Highways Access	4	4	16	NN	16
5.3.2 Rail Access to Site	6	6	36	NN	36
5.3.3 Airport Access to Site	4	4	16	NN	16
5.3.4 Water Freight Access	6	6	36	NN	36
5.4 Risk Factor: Social Infrastructure					
5.4.1 Healthcare (Local)	4	4	16	NN	16
5.4.2 Education (Schools)	6	6	36	NN	36
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	4	4	16	NN	16
5.5 Risk Factor: Labour					
5.5.1 Workforce	4	4	16	NN	16
5.5.2 Labour Costs	4	4	16	NN	16
				Average	**20.85**

SECTION B: BIOMASS AVAILABILITY AND PRICING

OVERVIEW

This section discusses the availability and pricing of wheat straw as a feedstock for bioenergy, biofuels, and other bio-based products within the BDO Zone region, with the centre point in Vegreville, AB, Canada. The town of Vegreville is part of Minburn County and is situated 120 km east of Edmonton, AB. The BDO Zone is delineated by a 120-km drive distance from Vegreville, AB, where wheat straw availability is assessed. The Competition Zone refers to the geographic area from which the existing feedstock consumers can influence wheat straw availability within a 240 km driving distance. Map B-1 below shows the overlay of the BDO Zone and Competition Zone. The BDO Zone region encompasses 24 counties (see Map E-1 in Section E).

Map B-1. Map of BDO Zone and Competition Zone



The agricultural profile of the BDO Zone is a mix of crops and cattle, notably featuring a major feedlot to the North in Two Hills, housing nearly 35,000 livestock. Consequently, substantial portions of land are dedicated to cultivating barley and oats, primarily for animal feed production. Cattle farmers in the area often grind wheat straw and grain for livestock feed, where corn planting is gradually increasing, predominantly for silage rather than grain production.[1]

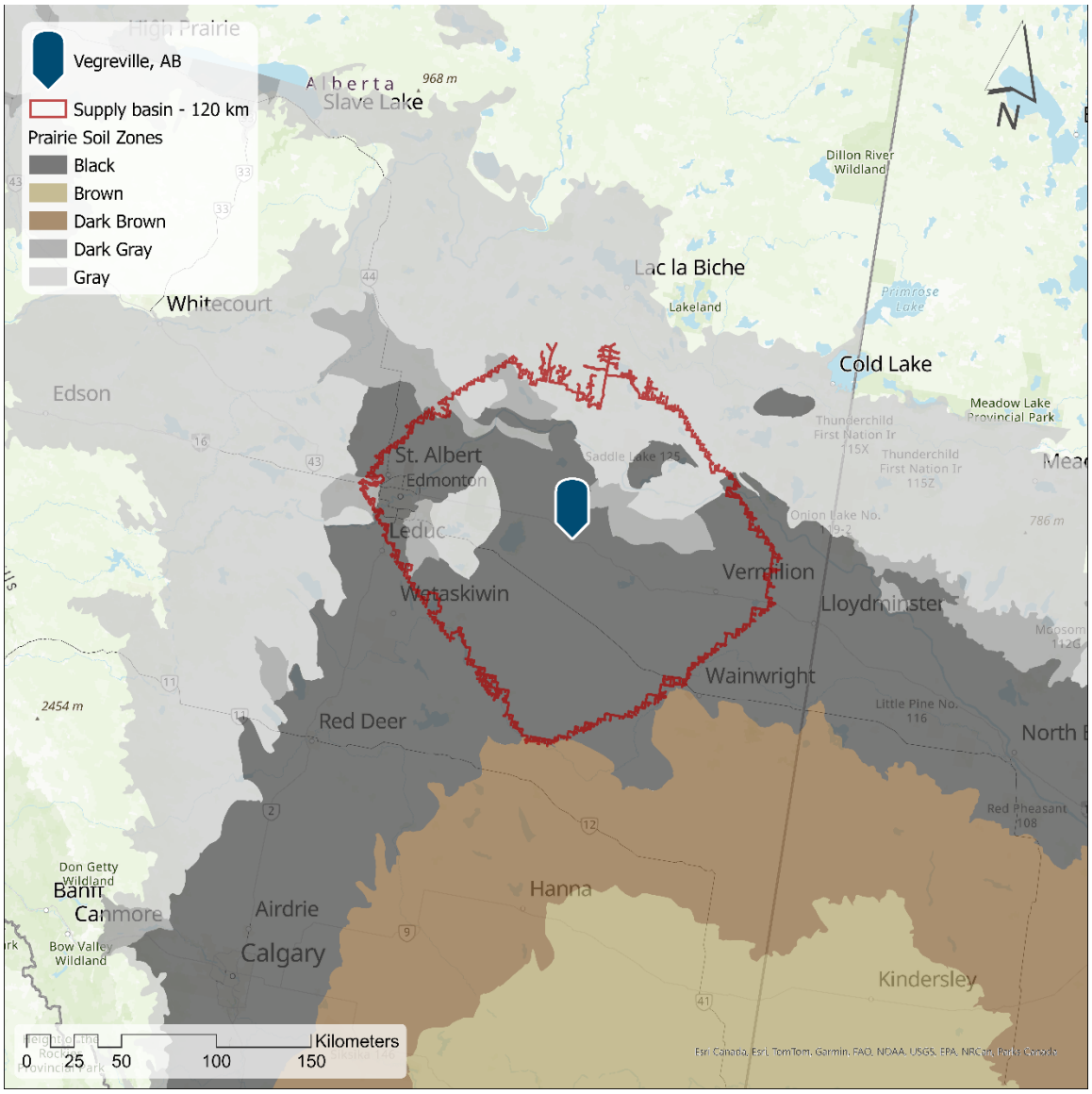
Wheat straw is a prominent resource for animal bedding, with approximately 20% of the wheat harvested area being baled for this purpose.[2] While many farmers possess their own round balers, the demand for baling services has led to the emergence of custom balers and haulers responsible for collecting and transporting straw from farm to buyer, providing the BDO Zone with an established infrastructure that could be incentivized to expand. The 2016 Census reported around 16,000 tractors and 4,000 balers in the BDO Zone. Moreover, the majority of round bales undergo wrapping to protect them from moisture and deterioration. Due to weather constraints, the baling window is relatively short, spanning approximately three to five weeks following the grain harvest.[3]

Supplier location relative to the buyer is a major factor in the current market for wheat straw bales, as the profitability of cattle operations requires straw to be sourced within a short drive distance (under 15 miles). However, crop growers who are not geographically near areas with high demand for straw are increasingly choosing to plant semi-dwarf wheat varieties. These varieties are shorter and produce less straw residue. This trend is observed despite only affecting a small portion of the planted area. The trend also extends to other forages like oats and barley.

The BDO Zone is one of the highest wheat-yielding areas in the country, supported by superior soil quality,[4] with an average of 50.7 bu/acre, around 8% higher than the provincial average of 47 bu/acre.[5] Soil quality directly affects yields (given a satisfactory weather pattern) and, consequently, farmer's willingness to participate in the supply of wheat straw. Map B-2 below illustrates the different soil types in the BDO Zone, where the black soil type is the highest yielding.

[1] Data gathered through outreach to local farmers and extension programs.
[2] Direct outreach to farmers
[3] Data gathered through outreach to local farmers and extension programs.
[4] https://www1.agric.gov.ab.ca/soils/soils.nsf/soilgroupmap?readform
[5] AGI/AFSC Crop Reporting Survey: https://open.alberta.ca/dataset/d72f8a52-818b-45b7-95ea-c9a9ee45b469/resource/1f28fc61-e09b-4cbd-b388-2dac2afc0abb/download/ab-crop-conditions-november-29-2016.pdf

Map B-2. Map of soil types in the BDO Zone.

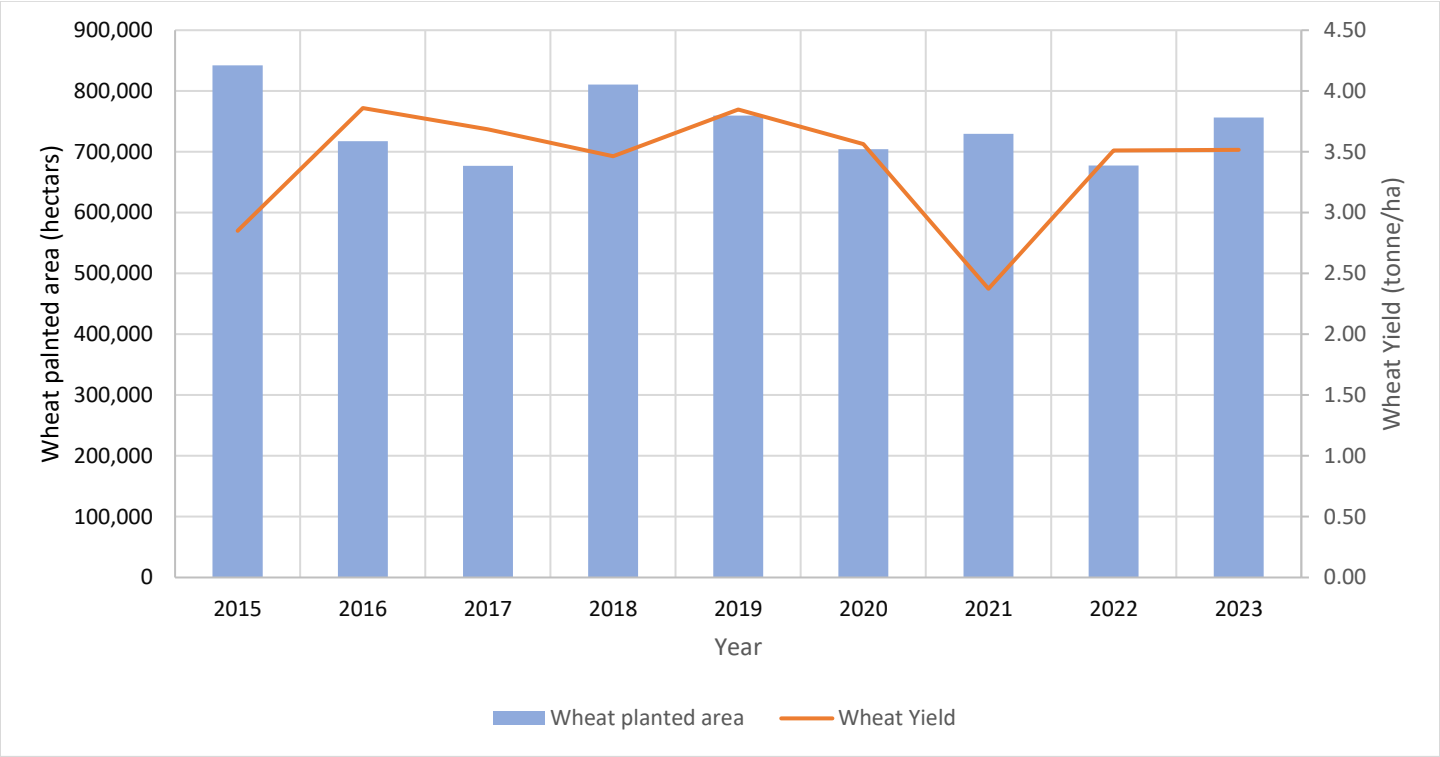


The wheat planted area has averaged 748,140 hectares in the last 10 years[6] with an average wheat production of 2,534,287 tonnes per year. Figure B-1 illustrates the yearly planted area and wheat yield over the period of 2015-2023. The yield drops of 2015 and 2021 are attributed to drought, more prominently in the latter year, 2021, when the absence of precipitation impacted the crops' initial growth stages.[7]

Map B-3 shows the wheat planted area in coloured hexagons of about 26 hectares.[8,9] In conjunction with Map B-2, the two illustrate that a large portion of the planted area is on very fertile black soil, contributing to the high wheat yields.

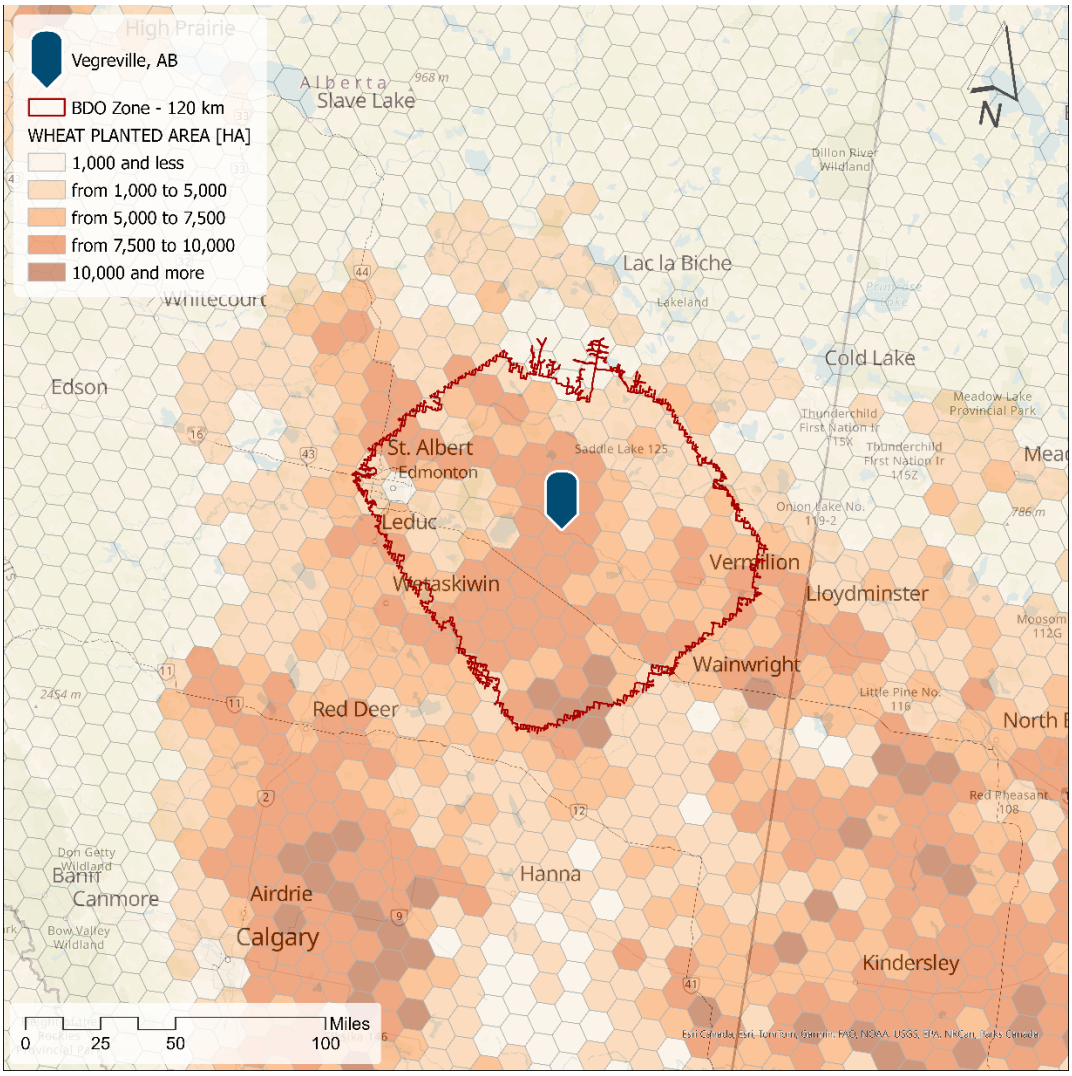
[6] Statistics Canada
[7] Personal communications with local farmers.
[8] Ecostrat modelling using GIS.
[9] Annual yield data source: AGI/AFSC Crop Reporting Survey

Figure B-1. Wheat planted area and yield in the BDO Zone



- Average planted area 748,140 hectares/year
- Average wheat grain production 2,534,287 tonnes/year
- Average wheat yields 50.7 bu/acre (3.41 tonnes/hectare)

Map B-3. Distribution of wheat planted area in the BDO Zone[10]



EVALUATED FEEDSTOCKS

The evaluated feedstock for the BDO Zone is wheat straw, which is the byproduct of wheat grain production.

[10] Source: Statistics Canada

SUPPLY ANALYSIS

In this risk rating assessment, the rated quantity is estimated as the low-risk biomass availability that a prospective bio-based project is likely to encounter within the BDO Zone, accounting for factors such as competition, logistics, sustainability, and operational constraints. Essentially, it serves as a conservative estimate of biomass availability for future ventures. This report employs six parameters to estimate the rated quantity of wheat straw in the BDO Zone:

(1) **Average annual wheat grain production**: This parameter relies on data provided by Statistics Canada[11] regarding the planted area, combined with yield data reported by the Alberta Ministry of Agriculture and Irrigation[12] to estimate the total quantity of wheat generated. Figure B-1 shows the historical planted area and the wheat grain yield.
(2) **Average annual wheat straw generation**: This parameter is estimated based on the average wheat yield and the straw/grain ratio.
(3) **Current demand:** The report estimates the amount of wheat straw currently utilized by livestock operations as the primary current end users of wheat straw through outreach to local experts and farmers. This quantity is subtracted from the total generation to determine the surplus available for other uses.
(4) **Sustainable removal quantity**: Published scientific reports were reviewed, and outreach to local producers was conducted to determine the portion of wheat straw left in the field for soil health reasons. Additionally, a field equipment efficiency rate is applied to further refine the estimate of available wheat straw for removal.
(5) **Farmer participation rate:** Factors such as wheat yield and soil type impact farmers' decisions on whether to supply their wheat straw to a new biomass project. A percent factor is applied to the sustainable removal quantity.
(6) **Biomass Availability Multiple (BAM):** The BAM serves as a mechanism to account for unknown risks related to the future wheat straw availability in the BDO Zone by discounting the available wheat straw estimated in Step 5. It calculates a low-risk rated quantity, providing a more conservative estimate of available wheat straw.

Detailed calculations for each parameter are presented below.

Step 1: Average production of wheat grain

As illustrated in Figure B-1, the wheat planted area has averaged 748,140 hectares with a yield of 50.7 bu/ha in the last 10 years, resulting in average wheat grain production of 2,534,287 tonnes per year.[13]

Step 2: Average production of wheat straw

The average production of wheat straw in the BDO Zone is estimated based on historical wheat production data spanning the past decade sourced from the Statistics Canada database. A straw-to-grain ratio of 1.6 is applied,[14] and the resulting quantity is converted to a bone-dry-tonne (bdt) measure by adjusting for 15% moisture content.[15] This figure represents the average annual wheat straw generation.

Wheat straw generation on the field is based on the wheat yield of 50.7 bu/acre, multiplied by the grain-to-straw ratio of 1:6 and free from moisture. Table B-1 outlines the calculations:

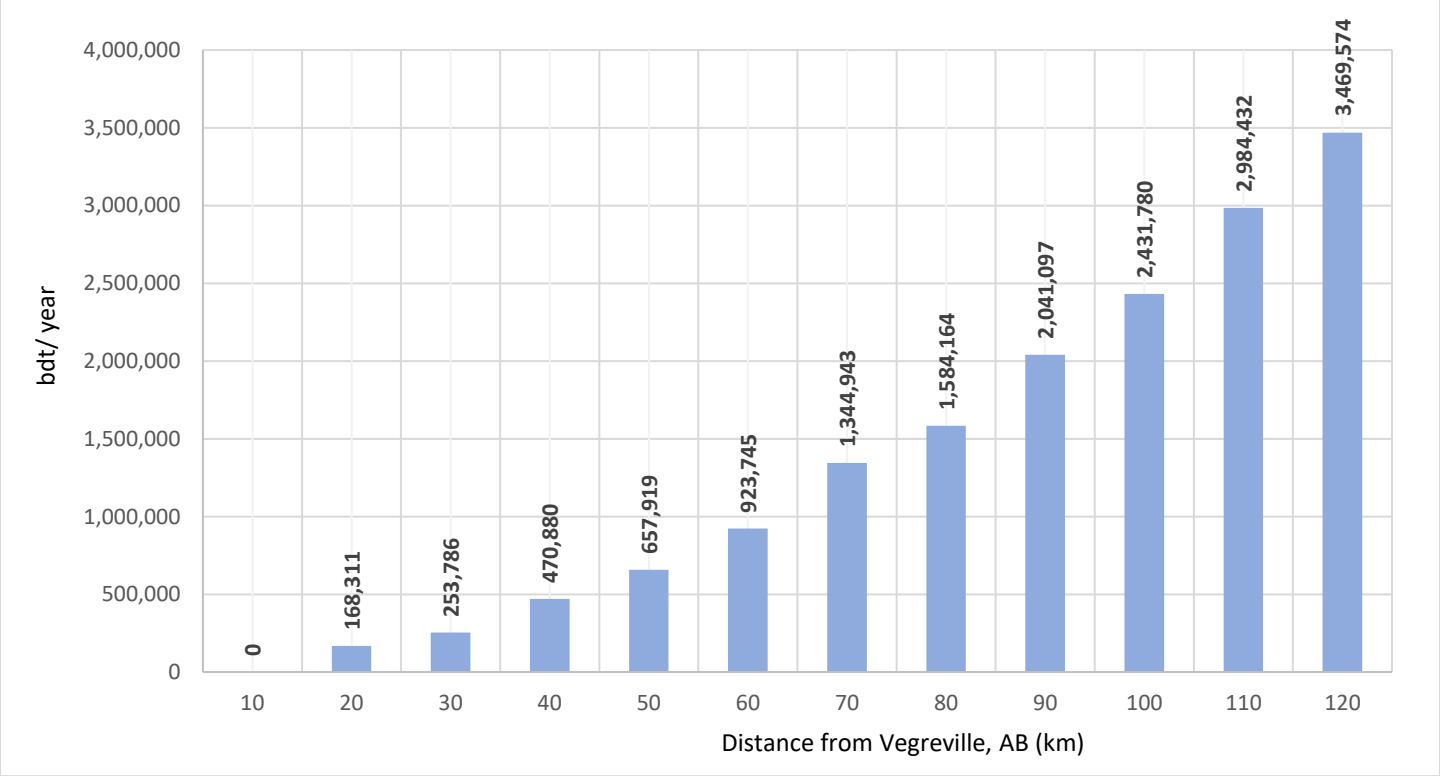
[11] https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3210035901
[12] https://www.alberta.ca/alberta-crop-reports
[13] Calculated by: avg planted area 748,140ha x ((avg yield in bu per acre 50.7)/ 14.87 (converts bu/ acre into tonne/ha)) = 2,534,287 tonnes/ year
[14]www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/crops-and-irrigation/field-crops/cereals-barley-wheat-oats-triticale/harvesting-surplus-cereal-straw.
[15] Ebadian, M.; Sokhansanj, S.; Lee, D.; Klein, A.; Townley-Smith, L. Evaluating the Economic Viability of Agricultural Pellets to Supplement the Current Global Wood Pellets Supply for Bioenergy Production. Energies 2021, 14, 2263. https://doi.org/10.3390/en14082263).

Table B-1. Wheat straw generation in the supply zone

Average area harvested in the last 10 years (hectares)	748,140
Average wheat yield in the last 10 years (bu/acre)	50.7
bu to tonne	36.75
Wheat yield (tonne (wet)/hectare)	3.41
Straw-to-grain ratio	1.6
Wheat straw moisture content at harvest time	15%
Wheat straw yield (bdt/hectare)	4.64
Average annual wheat straw generation (bdt/yr)	**3,469,574**

The supply curve in Figure B-2 estimates the potential availability of wheat straw by drive distance in 10-km increments from Vegreville, AB. In this model, the entire estimated quantity is factored in, as the exact location of each potential supplier remains unknown. The graph shows that approximately half of the generated quantity would be available around 80km drive distance. However, this figure is only a representation because accessing this biomass would require reaching a 100% collection rate, which is unlikely.

Figure B-2. Wheat straw supply curve



Step 3: Current demand for wheat straw in the BDO Zone

This parameter accounts for the primary demands for crop residue, such as animal feed or bedding. Due to the prevalence of livestock operations in this BDO Zone, wheat straw is collected mainly for bedding, while smaller quantities are used as a feed supplement. Data on current consumption was gathered and validated through outreach to farmers and local

experts, and it was found that close to 20% of all wheat planted area is harvested for straw. This figure, however, is highly variable among the micro-regions in the BDO Zone, as demand from livestock producers will influence the demand for wheat straw bales from the producers closest to their operations. The current demand is then deducted from the total wheat straw generation estimates (step 1) to determine the potential availability of wheat straw.

Table B-2. Potential availability of wheat straw after the competition

Percentage of biomass harvested for livestock uses	20%
Potential availability of wheat straw (bdt/yr)	**2,775,659**

Step 4: Sustainable removal quantity

Crop residue for wheat is the sum of straw, stubble, and chaff. It is noted that in much of the literature, residues and straw are used interchangeably. The crop-to-residue mass ratio for wheat is 1.6, meaning for every tonne of grain produced, 1.6 tonnes of residue is generated. However, the grain to straw[16] ratio is only 0.6-0.8,[17] for the same 1 tonne of grain.

The sustainability removal rate estimates from agronomic research[18] recommend about 40% of total residue to be harvested, meaning that for every one tonne of residue generated, only 0.4 tonnes (400kg) be removed as feedstock, while 0.6 tonnes (600kg) be left in the field for its organic matter.

This conservative approach accounts for farmer concerns with organic matter depletion, soil erosion, and water runoff. However, regional variations in field and soil conditions and agricultural practices may impact willingness to remove biomass at lower or higher rates than what is suggested in this report. Thus, a 40% removal assumption is utilized, recognizing potential discrepancies between regional conditions and research findings from other provinces and countries.

Recognizing that not all wheat straw can be effectively collected during harvesting operations, an equipment efficiency factor of 82% is applied to the sustainable removal quantity determined in step 3.

Table B-3. Sustainable removal quantity calculations

Soil Sustainability Factor (percent left in the field)	60%
Harvest Equipment Efficiency to remove wheat straw	82%
Sustainable removal quantity (bdt/yr)	**910,416**

Step 5: Farmer participation rate

The farmer participation rate indicates the anticipated proportion of crop growers willing to harvest commercial quantities of wheat straw for a new bio-based project within the BDO Zone. Factors like slope limitations, agricultural practices, soil quality affecting yields, and soil health concerns may hinder some farmers from participating. Hence, the farmer participation rate, expressed as a percentage, is factored into the sustainable removal quantity. This estimate applies to crop growers who theoretically are not currently involved in the supply chain, as an estimated 20% of growers currently supplying and using wheat straw have been excluded from the calculation in step 2.

[16] This ratio referes exclusevely to straw, and does not include stubble and chaff.
[17] https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/crops-and-irrigation/field-crops/cereals-barley-wheat-oats-triticale/harvesting-surplus-cereal-straw#:~:text=Straw%20to%20grain%20ratio%2C%20and,wheat%20(grain)%20harvested
[18] https://onlinelibrary.wiley.com/doi/epdf/10.1111/gcbb.12774

Outreach to local farmers found that they would be willing to sell their residue or bale wheat straw for the right price. Yields significantly influence farmers' willingness to remove biomass from the soil. Given that most of the BDO Zone has highly productive soil and that outreach indicates farmers' willingness to participate in the supply chain, a 60% participation rate is applied to the sustainable removal quantity. This results in a potential availability of 554,000 bdt/year of wheat straw.

Table B-4. Farmer participation rate quantities

Farmer Participation Rate	60%
Available quantity after farmer participation rate (bdt/yr)	**546,249**

COMPETITION ANALYSIS

There is no commercial-scale competition for wheat straw in the BDO Zone. Cattle producers are the main consumers of wheat straw bales, primarily for animal bedding and, eventually, as an animal feed supplement. Livestock producers prefer alternatives such as barley, oat, and increasingly silage due to better nutritional values and digestibility. These producers prefer to source straw from nearby suppliers to minimize transportation costs.

One company producing innovative fibre products located northwest of Edmonton, about 115km away from the centre point of the BDO Zone, is reportedly sourcing 30,000 tonnes per year of straw. However, they receive all kinds of straw, not solely wheat. Given this facility is at the edge of the BDO Zone, its small annual demand and the fact that it can take other kinds of agricultural residues, this operation is unlikely to pressure new entrants on the availability or price of wheat straw bales.

RATED QUANTITIES AND PRICING

New entrants may underestimate the challenges related to establishing or scaling up a supply chain, especially in the absence of traditional large-scale markets for crop residues. Additionally, unknown risks may be present at the time of a new project deployment. As a result, only a portion of the wheat straw produced is expected to be available for biomass projects. To mitigate these uncertainties, a Biomass Availability Multiple (BAM) factor is applied to the field removal quantity.

Biomass Availability Multiple (BAM) introduces redundancy into the supply chain by considering unknown or uncertain risks associated with the length of the harvest season and the actual number of harvested hectares, farmer participation rate, and scaling up an agricultural residue supply chain. It also accounts for the challenges of reliably obtaining commercial quantities of wheat straw at specific quality standards. Essentially, the BAM serves as a multiplier to adjust the estimated quantity, considering potential risks and uncertainties inherent in the supply chain.

This risk rating assessment considers a BAM of 1.2 due to the historically large amounts of wheat production and yields in the BDO Zone and the fact that some crop producers already harvest and collect or otherwise supply wheat straw as biomass to support the current livestock producers.

Table B-5: Rated quantity calculations

BAM Factor	1.20
Rated Quantity of wheat straw for the BDO Zone (bdt/yr)	**455,208**
Rated quantity to total production ratio	13%

In summary, the rated quantity is derived by subtracting from the total wheat straw generation: current demand (step 3), the sustainable amount that must remain in the field and field operation efficiency (step 4), farmer participation rate (step 5) and BAM factor (step 6), as delineated in Table B-6.

Table B-6. Summary of parameters and their description to estimate the rated quantity

Parameter	Description
Total wheat grain production *2,534,287 tonnes*	Based on Statistics Canada planted area data *(Step 1)*
Total wheat straw generation *3,469,574 tonnes*	Based on Statistics Canada data and a 1:1.6 ratio between grain and wheat straw *(Step 2)*
Potential availability *2,775,659 tonnes*	Total wheat straw generation minus the current demand *(Step 3)*
Sustainable removal availability *910,416 tonnes*	Potential availability after applying sustainability factor for soil organic matter and field equipment efficiency *(Step 4)*
Farmer participation quantity *546,249 tonnes*	Willingness of farmers to enter the supply chain by providing wheat straw. *(Step 5)*
Rated quantity *455,000 tonnes*	BAM factor is applied to the farmer participation quantity *(Step 6)*

The price calculated in this report estimates the range a new bio-based project would need to pay suppliers to secure the wheat straw quantity. This estimate is based on outreach to local producers and includes costs for nutrient replacement, baling, collection, edge-of-field stacking, and transportation.

The farm-to-gate cost encompasses the field operations, including baling, collecting, moving, and stacking straw bales to the edge of the field, as well as the nutrient replacement costs paid to the crop growers. Assumptions used in the calculations are as follows:

(1) The bale weight (wet basis) is 1,100lb[19] at 5'x6' for round bales, equivalent to about 0.5 tonne or 0.43 bdt.
(2) Field operations (baling, moving and stacking at the edge of the field): $16-21/bale or $37-49/bdt.[20]
(3) The material cost represents the expected cost required to replace nutrients due to the removal of biomass from the soil. Two methods were applied to estimate the straw cost:
    a. Literature reports material cost at $13.71/bale, or $31.88/bdt.[21]
    b. Nutrient replacement calculations based on amounts on a per bale basis as shown in Table B-7[22,23] at $17.89/bale or $41.60/bdt.

[19] Producer feedback from outreach varies between 1,000lb and 1,350lb.
[20] Outreach to local farmers; Inflation adjusted baling cost from custom survey.
[21] Published paper by the Alberta Agriculture and Forestry (https://open.alberta.ca/dataset/690317b0-1d07-4f9e-ae71-6340e16f6493/resource/89789096-1c7a-47ab-beb2-94d55606c922/download/af-straw-manufacturing-in-alberta-2020-01.pdf) reported in 2020 dollars and adjusted for inflation (https://www.bankofcanada.ca/rates/related/inflation-calculator/); considering a 1,100lb bale.
[22] https://www.albertagrains.com/files/2022/09/straw_management_in_western_canada_wheat_and_barley_cropping_systems.pdf
[23] https://calculators.masc.mb.ca/calculators/straw-cost

Table B-7. Nutrient replacement calculations

Nutrient	lb/tonne in wheat	Fertilizer Prices ($/tonne)	Replacement Value $/bale	Replacement Value $/bdt
Nitrogen (N)	13.6	959	5.16	12
Phosphorus (P)	4.5	1,148	2.48	5.76
Potassium (K)	27.2	725	8.20	19.08
Sulphur (S)	3.2	615	2.05	4.76
			$17.89	**$41.60**

Producer's profit is a necessary component of the cost composition as it is the measure by which the farmer gauges profitability per hectare and is incentivized to participate in the supply chain with the additional post-harvest operation. The profit range is about 20% of the base price at the farmgate.[24]

Table B-8 summarizes the farm-gate price of wheat straw, ranging between $35-47/bale or $84-109/bdt.

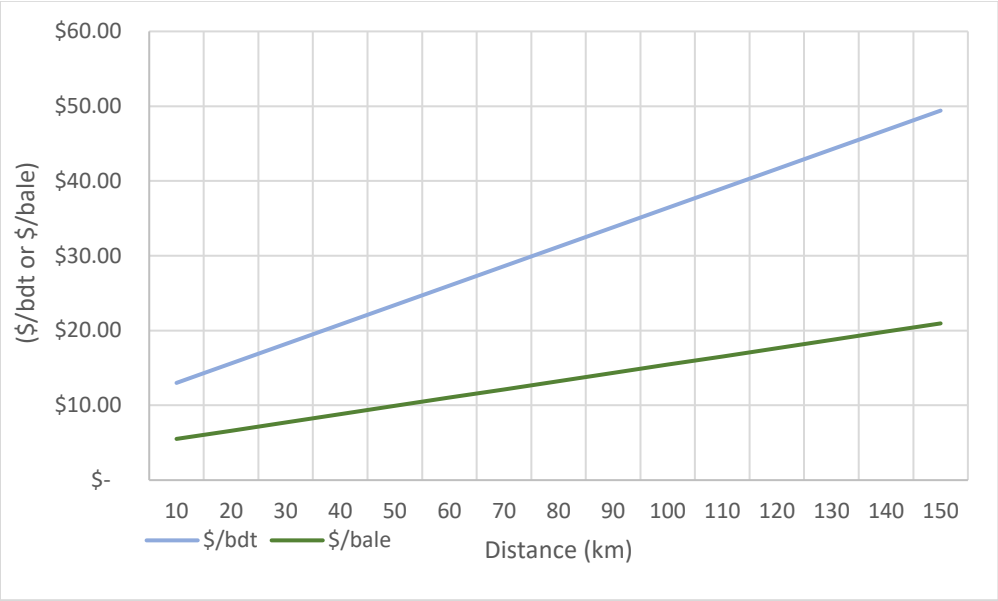
Table B-8. Farm gate price.[25]

Price Component	$/bale	$/bdt
Baling/Moving/Stacking cost	16 - 21	37 – 49
Nutrient replacement cost	13 - 18	33 – 42
Producer margin (20%)	6 – 8	14 – 18
Calculated price at farm gate	**$35 – 47**	**$84 – 109**

The transportation costs in the BDO Zone are calculated assuming an average drive distance of 80 km at an hourly rate of $150[26] in 53-ft flatbed trailers with a payload of 14.62 bdt.[27] Figure B-3 shows the transportation cost as a function of distance. The transportation cost for wheat straw bales is $13.23/bale or $30.78/bdt for the average drive distance of 80 km.

[24] Personal communication with farmers – profit margins are subject to change based on market conditions.
[25] Amounts in dollars have been rounded.
[26] af-alberta-custom-rates-survey-hay-and-silage-operations-2018.pdf
[27] 34 round bales; 1,100 lb each.

Figure B-3. Transportation cost curve



In conclusion, the rated quantity of wheat straw in the Vegreville BDO Zone is estimated to be 455,000 bdt/year at an estimated delivered price range of between $48-60/bale or $115-140/bdt, as shown in Table B-9.

Table B-9. Delivered price range.

Price Component	$/bale	$/bdt
Price range at farm gate	35 – 47	84 – 109
Transportation cost to 80 km	13	31
Delivered price range	**48 – 60**	**115 – 140**

SECTION C: INFRASTRUCTURE



PROPERTY OVERVIEW

City:	Vegreville
Province:	Alberta
County:	N/A
Acres:	72
Pricing Note:	$50,000CN
Topography:	Gently rolling
Zoning:	M-2 Heavy Industrial

SITE CONTACTS

Economic Development Contact
Bob Bezpalko
Alberta Hub
780-645-1135
bobbezpalko@albertahub.com

ADDITIONAL NON-RATED SITES

Infrastructure Site Contact
Bob Buckingham
bob@ecostrat.com

PROPERTY PROFILE

Prosperity Industrial Park is a 72-acre industrial park made up of 17 serviced lots ranging in size from approximately 1.48 acres to 22.16 acres. It is located on the east end of the Town of Vegreville's municipal boundary. It is bordered by Highway 16-A to the South, Range Rd 144 to the East, and Township Rd 522A to the North. All lots are presently available for sale by the Town of Vegreville.

The Town of Vegreville has and is specifically targeting the smart ag/agri-processing industry, including bio-economy development, as potential tenants for Prosperity Industrial Park due to the municipality's immediate proximity to agriculture lands and industry and major cross-country/continent transportation corridors.

Transportation

Nearest Highway: Hwy 16 (4 lane east-west) **Rail Served:** Yes, CN
Nearest high-load corridor: Highway 36 (major N/S) **Rail Accessible:** No current spur available
Nearest Airport: Vegreville Regional (5km) **Air Infrastructure in Place:** No
Nearest Commercial Airport: Edmonton International Airport (130 km)

Electric Service

Supplier: ATCO Electric **Website:** www.atcoelectric.com
Ownership: Canadian Utilities **All Utilities Extend to Site:** available
Phone: 844-687-2826 **Nearest Substation:** <1 km
Capability: Three phase, 25KV 5MW

Natural Gas

Supplier: ATCO Gas **Website:** www.atco.com
Ownership: Canadian Utilities **Size of Main:** 6" / 12"
Phone: 800-511-3447 **Pressure**: 60psi
Capability: 1200GJ/day

Water

Supplier: Town of Vegreville **Website:** www.vegreville.com
Ownership: Public **Size of Main:** 12"
Phone: 780-632-2606 **Peak Capacity:** text
Capability: Not Available

Wastewater

Supplier: Town of Vegreville **Website:** www.vegreville.com
Ownership: Public **Size of Main:** 6" – 12"
Phone: 780-632-2606
Capability: Not Available

Telecommunications

Supplier: Telus **Website:** www.telus.com
Ownership: Private **Platforms:** Wireless, fibre
Phone: 866-771-9666

SECTION D: 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: The BDO Zone is one of the most highly productive wheat straw regions in Canada, dating back one century. The average planted area in the past decade is 748,000 hectares, and yields average 3.41 tonnes/hectare, compared to the average provincial yield of 2.84 tonnes/ha.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**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 in supplying specific competitors with biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, 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 competitors, resulting in supply disruptions for the Issuer.

Risk Information: In the BDO Zone, there is no large-scale demand for wheat straw bales. Only about 20% of produced wheat straw is baled for use by the cattle industry as bedding and feed. Spot market straw bales suffer sharp price variations year-to-year, given changing yields due to precipitation. Most of the straw is valued by farmers as organic matter contributing to their soil health. The competition for straw from the cattle producers is limited, and if the straw bale supply increases, the price is likely to come down. However, farmers attach value to their straw and will be expected to be compensated financially. So, farmers prefer to sell their straw at a higher price and have no vested interest or preference in supplying a specific market.

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

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

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

Risk Information: Crop growers own or lease the land. Given the high productivity and demand for wheat, ownership is not expected to affect wheat straw generation within the BDO Zone.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

1.3.2 Ownership of Equipment

Rationale: In most cases, suppliers that own or lease equipment for harvest, collection, and processing feedstock are at lower risk than those that 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 convenient harvest times, 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, using 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: The small-scale demand for wheat straw bales comes predominantly from cattle producers. These farmers own the majority of the harvest equipment in the BDO Zone, with a smaller number of crop growers owning a smaller portion. A large-scale harvest operation would require a significant increase in equipment availability; however, the region is familiar with this practice, and farmers have indicated that they would be open to investing in equipment

if the demand for bales and pricing were satisfactory. Additionally, custom balers operating in the BDO Zone can also be incentivized to enhance their operations.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

1.3.3 Ownership of Transportation/Logistics

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

Risk Information: As a strong agricultural region with multiple types of crops and cattle operations, there is a well-established transportation infrastructure among producers. Transportation companies provide services during the grain harvest and have additional capacity post-harvest season. Although commensurate with the current production profile in the BDO Zone, an industrial-scale facility would likely demand the scaling up of the transportation equipment, especially during the harvest 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 medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	**24**

1.3.4 Feedstock as a Secondary Transformation

Rationale: Secondary transformation is dependent upon the production of primary products. Forest residues, corn stover, bark, and sawmill chips (unless from a dedicated chip mill) are all secondary transformations of a primary product.

Risks are higher if the feedstock is a secondary transformation of a primary, more valuable product. In the absence of markets for the primary product, it may not be economical for suppliers to produce biomass on their own. 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 the 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 the production of the primary crop requires resources to be taken away from the production of the secondary crop (e.g., shorter harvesting windows due to weather), the secondary feedstock supply will suffer. In times of stretched resources, suppliers may also perceive the harvest and collection of the feedstock as a nuisance, potentially decreasing production levels.

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

Risk Information: Wheat straw is a by-product of wheat production, which has been consistently produced in the BDO Zone (Figure B-1). However, wheat yields and, consequently, straw availability may be affected by drought, as seen in 2015 and 2021. Erratic weather can also negatively affect the willingness of farmers to supply straw to the project in a given year. This can be exacerbated by cattle producers demanding more straw as fodder mix. However, BAM mitigates the risk by creating redundancy in the supply 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 medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	**24**

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: While cattle producers have extensive experience in harvesting straw for their own use, crop producers, though less experienced, are nonetheless well-versed in agricultural practices. Their familiarity with farming operations and equipment makes them adaptable to straw harvesting processes. While they may require some adjustment, their existing knowledge base facilitates a relatively smooth transition to incorporating straw harvesting into their operations.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

1.4.2 Production Scale Experience

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

Risk Information: Wheat straw harvesting in the BDO Zone is somewhat limited to cattle producers and crop growers at a lower scale. Scaling up the supply chain to meet industrial demand will require enhancements in equipment availability, labour, and logistical efficiencies. The 2016 Census reported that there were around sixteen thousand tractors and four thousand balers in the BDO Zone. Wheat straw harvesting and collection do not pose technical difficulties that experienced farmers cannot quickly overcome. The main risk lies in the acquisition of sufficient quantities of equipment and the labour required to operate them.

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

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 the supplier's equipment capability enables understanding of their ability to produce feedstock of suitable quality.

Risk Information: In the Northern Alberta region, where the BDO Zone is located, the most common equipment is round balers. While they produce lower-density bales than the square balers, the cost of acquisition and maintenance is significantly lower than that of a high-density square baler. Furthermore, round bales are not optimal for transportation when compared to square bales, which increases the truck payload. Although the BDO Zone's current infrastructure is based on round balers, a bio-based project would likely benefit and incentivize high-density square bales, requiring new entrants to the supply chain to invest in the more costly equipment. Custom balers are better positioned to make such investments compared to individual farmers, as their machinery will operate for longer durations, allowing for better returns on investment.

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

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, a by-product, or a residual from a more valuable product, suppliers may not put in sufficient effort for consistent production. The risk of breach increases when feedstock production and/or delivery compromise a supplier's ability to make a primary product.

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

Risk Information: Wheat straw is a by-product of wheat harvesting and is seen as an asset by farmers because of its organic value and contribution to soil health. Even though there is no cost associated with its use as residue in the fields,

farmers do demand to be financially compensated if part of the straw is removed from the soil. The current balers, who are cattle producers, will not be willing to sell bales, as this feedstock is a critical requirement for their primary livestock operation. However, the current amount of wheat straw being baled is low compared to the rated quantity of around 460,000, which is 13% of the total generation in the BDO Zone, and a new entrant likely would not suffer from breaches in supply due to production priority.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitors' 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 a competitor's geographical influence on new plants within a BDO Zone, including competitive advantages such as short hauling.

Risk Information: Cattle producers in the BDO Zone bale about 20% of the total wheat straw for bedding and fodder mix, posing no significant threat to supply or pricing for a new entrant. One operation located at the western edge of the BDO Zone, 115km from the centre, reportedly intakes 30,000 tonnes of straw annually but accepts all straw types, not just wheat. Considering their location, which increases transportation costs, and the rated quantity representing only 13% of total wheat straw generation, this facility's demand is unlikely to impact the supply or pricing for a new entrant.

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 X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)*	**Notch** **NN**

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

2.1.2 Current and Historical Consumption of Feedstock Quantity

Rationale: Clear understanding of feedstock consumption by key competitors for each rated feedstock type 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 the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).

Risk Information: Historically, wheat straw has primarily been used for cattle for bedding purposes, with a smaller quantity utilized in cattle feed mixtures. However, livestock producers prefer alternatives such as barley and oat straw if available. One plant operating in St. Albert, AB, is demanding 30,000 tonnes/year of straw. However, their demand can use all kinds of straw and not wheat exclusively. At the time of this rating, the straw mix of the operation is unclear. Overall, the consumption of wheat straw in the BDO Zone is low and presents little competition.

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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

2.1.3 Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay (or receive) for different feedstock types is essential in determining the Issuer's competitiveness and accurately assessing the delivered cost range in the BDO Zone rating.

Current and historical prices paid/received by competitors provide insight into their procurement behaviors and exert pressure on suppliers in the BDO Zone, such as the ability/willingness to pay premiums for feedstock during times of feedstock shortage or reduce prices (or cut-off deliveries) during gluts. Competitors that have the ability to offer higher prices for feedstock during feedstock shortages can pose a significant risk to the 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: The limited wheat straw demand in the BDO Zone constitutes a spot price market for the bales, which are subject to substantial price variations. Reported prices by farmers are in the $35-50/bale range (edge of the field). The calculated price (Table B-8) is $35 – 47/bale (edge of the field). Droughts and the availability of oats and barley for animal feed impact pricing in the BDO Zone. In the event of a new bio-based project significantly increasing availability, wheat straw bale pricing is likely to stabilize.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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 lead to higher prices, feedstock disruptions, shortages, supplier breaches, 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 the 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: Wheat straw bales are primarily used for cattle bedding. Outreach indicates stable livestock herd numbers, suggesting no anticipated demand growth. The current estimate of 20% straw utilization is considered conservative. Furthermore, competition from the facility in St. Albert is not deemed substantial enough to present a significant barrier to a new entrant.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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: Wheat straw bales are sold in the spot market due to the limited quantities traded in the BDO Zone. Outreach found no buyers that are able to influence pricing. Additionally, the rated quantity takes into account not only current demands but also discounts other risks through BAM, resulting in a low-risk rated quantity.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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.[28]

Risk Information: Livestock bedding is the primary market for wheat straw bales, while smaller amounts can occasionally be used as animal feed. However, livestock producers typically prefer barley or oat straw due to their superior digestibility and nutritional value. Although prices can vary significantly in the spot market, a bio-based project

[28] Bergtold, 2018.

that will generate industrial-scale demand will stabilize prices due to increased supply in the long term and significantly reduce the effects caused by temporary markets in the BDO Zone.
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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

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 competitive 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 Issuer's plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.
Risk Information: In the BDO Zone region, no large-scale facilities are currently operational, and cattle producers typically do not keep bales in storage as the bale quality deteriorates over time as animal feed. Therefore, there is no risk to a new entrant related to inventory.
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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

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 efficient discharge can occur.

Risk Information: There is no advantage in terms of the delivery hours and accessibility for the existing local competing markets that future biomass projects can not meet.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **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: In the current market, wheat straw bales do not have specific quality parameters. However, future biomass projects will likely have specific quality parameters, particularly bale size, shape and density as well as the moisture content and ash content. However, we do not see such quality parameters would put future biomass projects at a disadvantage once the biomass project establishes a long-term relationship with the crop growers.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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: Outreach has found that baler sales have been flat for a few years and that the cattle herds are not expected to increase in size but have been slowly decreasing. We do not expect demand pressure from current competitors or for additional wheat straw in the region.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

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: A Biomass Availability Multiple (BAM) of 1.2 was applied to increase redundancy of the supply chain given unknown risks in the BDO Zone. The resulting rated quantity of 460,000 bdt/year represents only 13% of the total straw generated. The data collected, coupled with outreach to local experts and farmers, provided sufficient feedback to validate the resulting rated quantity, which allows the application of a low BAM factor.

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 X RRI) is 24 out of 100.	**24**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch)	**NN**

No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. **24**

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: A supply curve in Figure B-2 depicts the potential availability of wheat straw based on distance from Vegreville, AB, providing an estimate rather than actual biomass availability within the BDO Zone. This curve suggests that the rated quantity could theoretically be obtained within a 40km drive distance. However, challenges arise due to limited information from farmer outreach and the uncertainty regarding the exact sources of the feedstock in each micro-region. This ambiguity complicates the calculation of cost impacts associated with extended supply distances, consequently heightening risk levels.

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

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[29] and can manifest in shortages and higher costs for Issuers.

Risk Information: The main source of seasonal variation is the harvest window. Wheat straw collection occurs after grain harvest. Outreach to farmers found that, ideally, wheat straw should be collected by following the harvester with a baler. However, this would be challenging in an industrial-scale operation as it can interfere with grain harvesting, which is the grower's main focus during harvest season. Weather conditions can negatively affect field operations, bale quality, transportation, or a combination of the three.

The window for straw harvesting is relatively short and uncertain, between mid-August and late October. However, the working window when the field is accessible can be between 3-5 weeks, which is the actual amount of time when the field equipment can be used in the field, as reported during outreach. The risks associated with this dynamic can be mitigated through a robust supply chain with sufficient quantities of equipment and crews to work within this timeframe; however, this is a long-term scaling-up plan, and the risks will persist until then.

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

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: Figure B-1 shows the historical wheat planted area (average of 750,000 hectares) and yields (average of 51 bu/acre) in the BDO Zone. Drought can affect wheat straw availability by lower wheat yields, such as observed in 2015 and 2021. The application of several restrictions to the wheat generated, in addition to BAM, mitigates the risk of droughts in the supply of straw. As an example, when comparing the rated quantity of 455,000 bdt/year to the drought of 2021, the BDO Zone still produced close to 2,700,000 bdt of wheat straw, making the rated quantity 17% of total generation. Conversely, weather effects during the harvesting season, such as windstorms and precipitation, can have a much greater negative impact than agricultural yields in terms of supply availability.

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

[29] Golecha & Gan, 2016.

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

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

Rationale: If the historical feedstock price shows volatility, 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: Due to low demand and a market driven primarily by livestock producers, bales are traded on the spot market. Changes in weather, yearly crop yields, and opportunistic buyers all influence prices, which show significant variability year-over-year (Figure E-4) and also within micro-regions within the BDO Zone. A new bio-based facility that will greatly increase demand will shift the spot market to a more structured long-term arrangement, lowering price volatility and consequently providing greater certainty to new suppliers.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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 the 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: The current supply chain for wheat straw is specifically designed to meet the requirements of the local cattle industry. At present, the cattle industry is the only consumer of wheat straw in that area. This is a small market with low historical demand. Commercial quantities of wheat straw bales will only be achieved once a credible project is established with stable feedstock demand. To support a large-scale biomass project, the BDO Zone will require increased equipment and labour availability, as well as improvements in harvesting and transportation efficiencies.

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

3.2.3 History of Production/Feedstock is a New/Secondary Crop or By-Product

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: The BDO Zone is a traditional crop-growing region where farmers have several decades of experience. Wheat straw harvesting and collection do not require advanced technical expertise, and experienced farmers entering the supply chain can scale up the biomass field operations. The region has maintained stable production quantities and crop yields over the past decade, ensuring a consistent supply of wheat straw.

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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **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: Over the last decade, the CPI in Canada rose 28%, while in Alberta, the rise was 26% (Figure E-1). Inflationary pressures in the consumer price index increase operational costs in wages, materials, and operating expenses. Similarly, over the same period, the industrial price product index (IPPI) in Canada rose 31% (Figure E-2), pressuring capital investment costs. The rise in these indices leads to rises in interest rates, which consequently make capital investments more costly, slowing down the economy. Changes in CPI and IPPI are not a competitive disadvantage in established supply chains, as all are impacted. However, the cost of feedstock, labour and capital may affect the decision of new entrants. Due to the direct correlation of these indices to base interest rates, which are the highest in the last 40 years, this category is deemed medium-high risk.

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

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 relevant.

Raw Risk Likelihood (RRL)	**Score**

The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**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 relevant.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed not relevant, therefore the RRL is not rated (NR).	**NR**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is not rated.	**NR**
Mitigation/Notching	**Notch**
The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**NR**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**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.[30]

Risk Information: Due to its lower nutritional value than barley, oats, and hay, wheat straw is not commonly used in animal feed. In the event of shortages or price fluctuations, wheat straw bales can be a replacement or a last resort; therefore, there is little influence from non-traditional competitors.

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 low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 8 out of 100.	**8**
Mitigation/Notching	**Notch**

[30] Bergtold, 2018.

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 8 out of 100.	**Score** **8**

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 risks, such as frost or rain.

For forestry biomass, unsightly clear-cuts 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 wheat straw harvest follows the wheat grain harvest, but adverse weather conditions can disrupt field operations and reduce biomass availability. Moisture from inclement weather can also compromise bale quality. Furthermore, the narrow 3 to 5-week window for wheat straw harvesting necessitates substantial resource allocation, which is the case for large-scale projects. Additionally, even though the BDO Zone has a significant agricultural transportation infrastructure, timely transportation of bales for storage (which will impact bale quality) may strain transportation companies and possibly lead to price increases.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X 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. Using 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 current practice in the BDO Zone involves using round balers for baling wheat straw, primarily due to their affordability and lower maintenance requirements compared to high-density square balers. However, this equipment setup is not optimized to meet large-scale production demands. Scaling up the supply chain would necessitate enhancing the number of equipment and their output.

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

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.[31]

Risk Information: Industrial-scale bio-based industries are likely to impose a quality standard, such as receiving wheat straw in high-density square bales. Achieving this density requires high-efficiency square balers, which are not common in the BDO Zone. Due to the absence of large-scale demand, quality standards among suppliers are lacking, increasing uncertainty. Incentives from anchor bio-processing facilities could encourage growers to invest in equipment and establish quality standards.

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**

[31] Huhnke, 2018.

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

3.4.4 Availability of Labour for Feedstock Production

Rationale: Skilled labour shortages can be difficult to remedy in the short term. The 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 Issuers for whom large feedstock requirements or the development of new (or expanded) supply chains demand significant additions to the local labour force.

Risk Information: Harvesting and collection of wheat straw are additional field operations following the grain harvest, and labour is crucial for the field operations during a 3-5-week period. Currently, field operations are conducted primarily by livestock producers, which are unlikely to divert resources to harvest and sell bales. Therefore, the supply chain will necessitate a new labour force to be trained as field operators. While Alberta, like the rest of Canada, faces a labour shortage, it stands out as the only province experiencing overall population growth. In the past year, the province welcomed over 200,000 new residents.

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

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 the average transport distance from suppliers to Issuers is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and 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: This report estimates that transportation costs account for 25-27% of the delivered feedstock price. Small increments in the average transportation distance can significantly increase the feedstock supply, as illustrated by the supply curve in Figure B-2, with marginal increases in delivered costs.

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

3.5.2 Diesel Cost Impacts

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

Risk Information: Short-term fluctuations in diesel prices can impact operational margins, but the probability of a significant risk is low. In recent years, diesel prices were affected by the pandemic in 2022 and Saudi Arabia and Russia's decision to cut 1.3 million barrels per day of production in 2023. Fluctuations are expected to continue due to international geopolitical uncertainties.

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 low, therefore the RRI is 4 out of 10.	**4**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 32 out of 100.	**32**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**

Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 32 out of 100.	**32**

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 of required transportation equipment, equipment owners have increased leverage over transportation prices and supply chain resiliency can be lower.

Risk Information: Transporting bales does not necessitate specialized equipment. Typically, 53-foot flatbed trailers and B trains are used, both readily available in the BDO Zone.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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 the power to force regulations regarding truck transport, impeding the ability of BDO Zone suppliers to transport feedstock.

Risk Information: The BDO Zone is a traditional agricultural region where grain, livestock, and fertilizer are commonly transported. The addition of a bio-based project would mean heightened traffic in the months following grain harvest. This report assessed an industrial park located at the intersection of Highway 16, where feedstock delivery could be planned to avoid local communities.

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 X RRI) is 16 out of 100.	**16**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**NN**

The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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.

Risk Information: Road restrictions are enforced during the spring, typically from April to early May, depending on early spring conditions.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **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: Vegreville is located near a designated High-Load Corridor consisting of highways that have had the overhead utility lines raised to accommodate loads up to 9 metres high (Map C-1). Outreach has found that there are no major issues with Provincial roads; however, increased traffic on the local roads would necessitate increased maintenance due to heavy-load traffic.

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 X RRI) is 24 out of 100.	**Score** **24**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)*	**Notch** **NN**

No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100. **24**

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: Outreach to local farmers and experts found that there are sufficient numbers of trucks and trailers that can be used to transport feedstock. This report calculates that 34 trucks would be necessary to move the rated quantity in a season when most of the grain transportation will be completed. However, there is no redundancy in the transportation infrastructure, and competition for services may increase the risk of availability and/ or prices. The length of the wheat straw harvesting season and weather impacts on feedstock quality necessitate transportation scale-up to match the requirements of a new industrial entrant.
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 X RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X 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: The BDO Zone is comprised of almost six thousand farms, with an average size of 975 acres, which means the availability of wheat straw varies in quantity and location from season to season. The fragmented nature of

this supply chain and the fact that not only market forces but specific field yields may sway farmers from participating increase the risk of managing the feedstock suppliers.
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 X RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X 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 supply of agricultural residues, such as wheat straw, is supported by hundreds of farmers distributed throughout the BDO Zone. Wheat is a primary cash crop for farmers in the BDO Zone. As shown in Figure B-1, the wheat planted area has averaged 748,140 hectares in the last 10 years, with an average wheat production of 2,534,287 tonnes. Even in the years where drought affected yields and overall production, this report applies constraints and a BAM factor in calculating a low-risk rated quantity that is intended to mitigate such risks.
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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

3.6.3 Land Ownership Structures

Rationale: The ownership (or control) of the land base on which feedstock is produced can have a significant impact on the 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, is 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: In the agricultural lands of the BDO Zone, wheat as a cash crop has historically constituted, and is poised to continue as, the primary utilization of the region's acreage, regardless of land ownership structure. Outreach has found that land leases are in the minority.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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: Weather conditions post grain harvest play a crucial role during the brief collection window for wheat straw, where precipitation can impede field operations and compromise bale quality, which can sustain long periods of moisture in a season where drying is slow. Additionally, windstorms can scatter wheat straw from the fields. Seasonal weather has a higher likelihood of affecting baling operations than the generation of wheat straw, especially considering that the rated quantity is 13% of the straw generated in the BDO Zone, providing redundancy for potential fluctuations in wheat yields.

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

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: Considering the historical production of wheat within the BDO Zone and the absence of reported long-term weather trends or concerns in the region, there is no apparent risk to the sustained availability of wheat straw and its associated supply chain.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.7.3 Forest/Crop Fire

Rationale: Forest/crop fires, especially when occurring on a 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 investigating adaptation strategies and options to deal with future fire

occurrences. There is growing consensus that as wildfire activity increases, fire agency suppression efforts will be increasingly strained. However, analyses of fire history suggest that the effect of climate variability on precipitation regimes is the primary reason for the decreasing fire activity in the southern BDO Zone of Canada.

Risk Information: There are no reports of fires affecting wheat production in the BDO Zone.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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: Farmers regularly monitor their crops for signs of pests throughout the growing season and take proactive measures to prevent infestations. There are no reports of wheat infestation in Alberta.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**

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

3.7.5 Risk of Hail

Rationale: Hail has negligible impact on 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 increases.

Risk Information: Hail occurrence is not common in the BDO Zone, and in instances where it has caused minor damage, it is more likely to affect canola, oats, or barley because wheat has a tougher head compared to the others.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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: Outreach has found that floods do not pose a risk to the feedstock supply.

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 X RRI) is 4 out of 100.	**4**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment.	**NN**

The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100. **4**

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: Drought can impact wheat production and, consequently, wheat straw availability. Historical data point to two years of decreased yields due to weather in 2015 and 2021 (Table A-1). Although BAM accounts for redundancy in the supply chain and the rated quantity is 13% of total wheat straw generation, in the case of drought, wheat straw availability in the fields may be impacted in the lower-yielding regions of the BDO Zone.

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

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: Outreach has found no risk associated with this risk indicator.	
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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

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: The 10-year wheat production quantities exemplified in (Figure B-1) show that low temperatures do not affect wheat yields as much as drought does. After wheat grain harvesting is completed in the fall, colder temperatures do not affect wheat straw as a residue.	
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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X 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 subsidies only; it does not apply to government subsidies that pertain indirectly to the Issuer's operations, such as Loan Guarantees, or to the markets for products produced by the Issuer.
Risk Information: Wheat and wheat straw production and use are not subject to government subsidies. Consequently, wheat straw availability and/or price are not affected by this category.
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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. — **16**

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 biomass utilization requires specific permits (e.g., 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), the likelihood of obtaining such permits and/or complying with permitting requirements should be examined.

Risk Information: Wheat production and wheat straw harvesting are not subject to specific regulations that encourage/discourage their production.
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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**

The Loaded RI Score ((1-Total Notch) X 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: Outreach has found that the BDO Zone is open to new bio-based development, and farmers are willing to supply feedstock given the right price.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 8 out of 100.	**8**

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: Outreach has found that more partnerships between Indigenous communities and industry are increasing economic development in the region.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

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, the 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: Wheat straw bales are a by-product of wheat grain production and exert no influence on food prices or availability.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**4**

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

Rationale: Public concerns about the 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: Wheat straw sustainability relates closely to the impact on soil health, where biomass acts as a source of organic matter, supporting yields in the long term. The rate of straw removal is an individual decision for each producer, and as the stewards of their land, they are acutely aware of the nutrient value of this residue. Nevertheless, the rated quantity in this report is calculated by applying a sustainable straw removal factor of 40%. A future biomass project needs to work with each individual supplier to make sure the removal rate does not impact soil health in the long run.

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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

3.9.2 Risk to Soil Quality

Rationale: Soil sustainability can be defined as the 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 the 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 that can degrade the soil and its nutrients.

Risk Information: One of the primary challenges for wheat straw removal is ensuring sufficient nutrient retention in the soil and preventing erosion. However, growers are aware of these risks and will manage the quantities being harvested to ensure long-term maintenance of soil quality. In the event of a bio-based project demanding large quantities of feedstock, there are other techniques available to maintain soil quality, such as nutrient replacement (animal manure) and winter cover crops. As mentioned before, we considered 60% of the produced wheat straw is left behind in the field to maintain soil organic matter.

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 X 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) X (RRI Notch) is NN (No Notch).	
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

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: As an agricultural byproduct, wheat straw production and use do not impact this risk indicator.	
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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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: As an agricultural byproduct wheat straw does not demand any water use.	
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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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: In Alberta, the basis for regional land-use planning is the Alberta Land Stewardship Act (ALSA), from which several Acts are amended to regulate conservation, agricultural operations, and the environment, among other things. There are no reported adverse effects from pesticide use in Alberta.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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: Agricultural operations are subject to the Alberta Land Stewardship Act, and harvesting agricultural residue does not present a risk for wildlife or landscape.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

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 applicable to wheat straw.

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

The risk impact is deemed not relevant, therefore the RRI is not rated (NR).	**NR**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is not rated.	**Score** **NR**
Mitigation/Notching The Total Notch (RRL Notch) X (RRI Notch) is NR (Not Rated).	**Notch** **NR**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is not rated.	**Score** **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: As a byproduct of wheat cultivation, the quality of straw is primarily determined by the methods used during harvesting and storage rather than during planting. Given this biomass's brief harvest window, its quality will unlikely decline significantly due to weather exposure. Field operations and storage play crucial roles in determining the quality of the straw, as factors like high ash concentration or exposure to precipitation during these stages can significantly affect its integrity due to moisture content. In the BDO Zone, wheat straw bales currently lack quality standards due to limited use; however, with an increase in demand from a new bio-based facility, quality control is expected to become a critical factor for feedstock supply.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **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: In the BDO Zone, a new project would require approximately 70 balers, 70 bale collectors, 140 tractors, and 34 trucks with 53 ft flatbed trailers to harvest, collect, and transport the rated quantity of 455,000

bdt/year. While these needs may seem feasible with current equipment and labour availability, achieving efficient baling and transportation on a large scale would likely necessitate investment by the suppliers in high-density square baling equipment and flatbed trailer by transportation companies. Although outreach has found that farmers would be willing to participate in the supply chain under favourable conditions, the scale-up timeframe presents a medium risk level.

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

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Industrial District

Risk Information: The assessed site is a 72-acre industrial park made up of 17 serviced lots ranging in size from approximately 1.48 acres to 22.16 acres, zoned as M2—Heavy Industrial District. It is located on the east end of the Town of Vegreville's municipal boundary. The town is currently offering all lots for sale. Currently, no existing infrastructure or industry is operating in the park.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

5.1.2 Ownership of Land

Risk Information: The Town of Vegreville owns all lots within Prosperity Industrial Park, which are available for purchase at $50,000 per acre. The park actively promotes bio-based projects, receiving strong encouragement and support from municipal and provincial levels. This support includes initiatives like Alberta's Agri-Processing Investment Tax Credit, which offers a 12% non-refundable tax credit for projects exceeding $10 million to build or expand value-added agri-processing facilities in the province.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

5.1.3 Permitting Description

Risk Information: Per the 2022 CHBA Municipal Benchmarking Report,[32] permitting timelines in the Town of Vegreville are reported to last several weeks, notably quicker than Edmonton's 7.2 months and Calgary's 5.4 months. The permitting process typically requires development and building permits to adhere to local bylaws and the Alberta Building Code. Non-conforming projects might necessitate additional applications, such as a Land Use Bylaw Amendment or Rezoning. The industrial park is a greenfield development subject to the same permitting process.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

[32] https://st.chba.ca/CHBADocs/CHBA/HousingCanada/Government-Role/2022-CHBA-Municipal-Benchmarking-Study-web.pdf (pg. 44, figure 34)

5.1.4 Environmental Issues

Risk Information: The site does not have any reported environmental liabilities, such as soil contamination or the risk of flood and fire, that could complicate the development of a biomass project.

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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: The park currently has no natural gas line. Installation service is scheduled for 2024. The provider will be ATCO Gas. Natural gas costs can be found in Table C-1. The natural gas mains are planned to have a capacity of around 1,200 GJ/day. As of January 2024, the average price of Natural Gas in Alberta stood at $2.63 per GJ or $2.78 per Mcf, which is a competitive price in the province.

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

5.2.2 Electric Availability

Risk Information: Currently, no electrical connections are available at the park. However, ATCO Electric will provide electrical power, with plans for a 3-phase 25 KV 5 MW supply. Shallow service installation, including electrical power, is

scheduled for the 2024 construction season. In 2023, the average total cost of electricity in Alberta, based on monthly consumption of 1,000 kWh, was 25.8 cents per kilowatt hour.

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

5.2.3 Water Availability

Risk Information: There are no natural freshwater sources available. However, treated water is available. Water and sanitary deep services are present at each lot's property line. Furthermore, water disposal is managed through piped systems, with no reported environmental issues.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 24 out of 100.	**24**

5.2.4 Waste Disposal

Risk Information: The Vegreville Sanitary Landfill is located 3.2 kilometres (under a 5-minute commute) north of the industrial site. It is an Alberta Class II C Sanitary Landfill (Table C-2). Additionally, Quest Disposal & Recycling is a private waste disposal company located in Vegreville.

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

5.2.5 Internet Availability

Risk Information: The industrial site is a greenfield and still requires communications to be installed.	
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 X 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) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: The site is located adjacent to Highway 16A, which is connected (1 kilometre away) to TransCanada Highway 16, a core highway listed as part of the National Highway System in Canada this corridor is a 4 lane east-west highway. Additionally, Vegreville is 22 kilometres west of Highway 36, a major north-south corridor connecting the U.S. and Mexican markets. This highway is a high load corridor. The site is directly serviced by Range Rd 144 and Township Rd 522A, both of which are paved.	
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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

5.3.2 Rail Access

Risk Information: The site is located immediately adjacent to a CN rail line. This line has a weight limit of 286,000 pounds and connects to a CN Intermodal Terminal in Edmonton, 116 kilometres west of Vegreville. However, there is no spur inside the industrial site.

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

5.3.3 Airport Access

Risk Information: The Vegreville Regional Airport is located approximately five kilometres north of Prosperity Industrial Park. The Vegreville Regional Airport features a 4,000 ft X 150 ft asphalt runway with runway edge and taxiway edge lighting, as well as three wind direction indicators and a strobe acquisition beacon. The Vegreville Regional Airport can accommodate all aircraft up to approximately 20,000 pounds. The closest international airport is Edmonton International, 130km west of Vegreville, transporting passengers and cargo. It is the nation's 5th busiest airport by passenger traffic.

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 X RRI) is 16 out of 100.	**Score** **16**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment.	**Notch** **NN**

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

5.3.4 Water Freight Access

Risk Information: River or ocean freight services are not available. The nearest port, the Port of Vancouver, operated by the Vancouver Fraser Port Authority, is approximately 1,260 kilometres away. Alternatively, the Port of Prince Rupert is 1,561 kilometres away.

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

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: St. Joseph's General Hospital, located in the town of Vegreville, is an acute care facility offering various health services, including emergency care, diagnostic imaging, hemodialysis, and laboratory services. Specialized health treatments are available at healthcare facilities in Edmonton, which is 1 hour away.

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 X 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) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**

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

5.4.2 Education (Schools)

Risk Information: Vegreville is home to two elementary and two high schools, which provide education for local families. For post-secondary education, Lakeland College is situated in Vermilion, approximately 90 kilometres east of Highway 16, a four-lane highway. It is an agricultural-based school offering a student-led farm and applied research in crops and livestock. Given the limited education options and the distance to the college, this category is rated as medium risk.

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

5.4.3 Local Transportation

Risk Information: The Town of Vegreville is serviced by two local taxi companies. KCTI Passenger Bus Services operates in the town, offering transportation to and from Edmonton (about 1h away) and eastbound routes to Regina and Saskatoon, Saskatchewan. No local public transit is operating, and the commute time from the town center to the industrial site is very short.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

5.4.4 Public Safety (Local)

Risk Information: Criminal Code Violations per 100,000 Population for Alberta decreased by 5.4% between 2018 and 2022. During the same period, violent crime increased by 14%, lower than the national rate increase of 18%. Vegreville is served by an RCMP Detachment.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

5.4.5 Housing/Cost of Living

Risk Information: Like many municipalities in Alberta post-COVID, the town of Vegreville has seen a surge in the local housing market but still has housing available. Compared to the provincial average, housing prices in Vegreville are approximately $250,000, while the provincial average is roughly $450,000.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: Vegreville, with a population of 5,689 and a median age of 45, boasts a median household income of $70,000 per year, 12% lower than the Provincial figure of $80,000 per year. The town's trade area (100km radius) encompasses nearly 30,000 individuals, offering a substantial labour pool for potential bio-based projects. Notably,

trade education comprises 12.3% of Vegreville's population, surpassing the provincial average of 8.7%. Furthermore, 46.9% of Vegreville residents hold a postsecondary certificate, diploma, or degree. The unemployment rate is 4.4%, lower than the provincial rate of 6.3%.

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

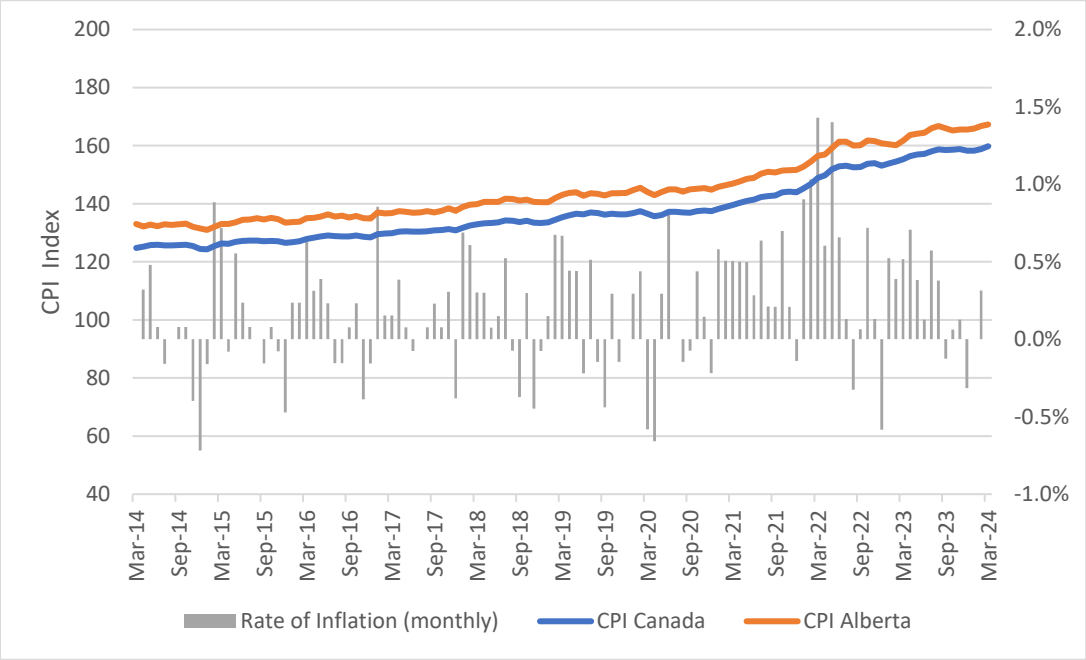
5.5.2 Labor Costs

Risk Information: The minimum wage in Alberta is $15.00 per hour, requiring a minimum shift of 3 hours each time the employee reports to work. Employees who are 'on call' or 'on standby' are not considered to be working. In Vegreville, the majority of salaries fall within the range of $33,000 (25th percentile) to $48,375 (75th percentile) annually, which is lower than the Alberta averages of $38,750 (25th percentile) to $61,250 (75th percentile).

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 X 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) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**16**

SECTION E: TABLES AND FIGURES

Figure E-1. Ten-year CPI Index and monthly rate of inflation[33]



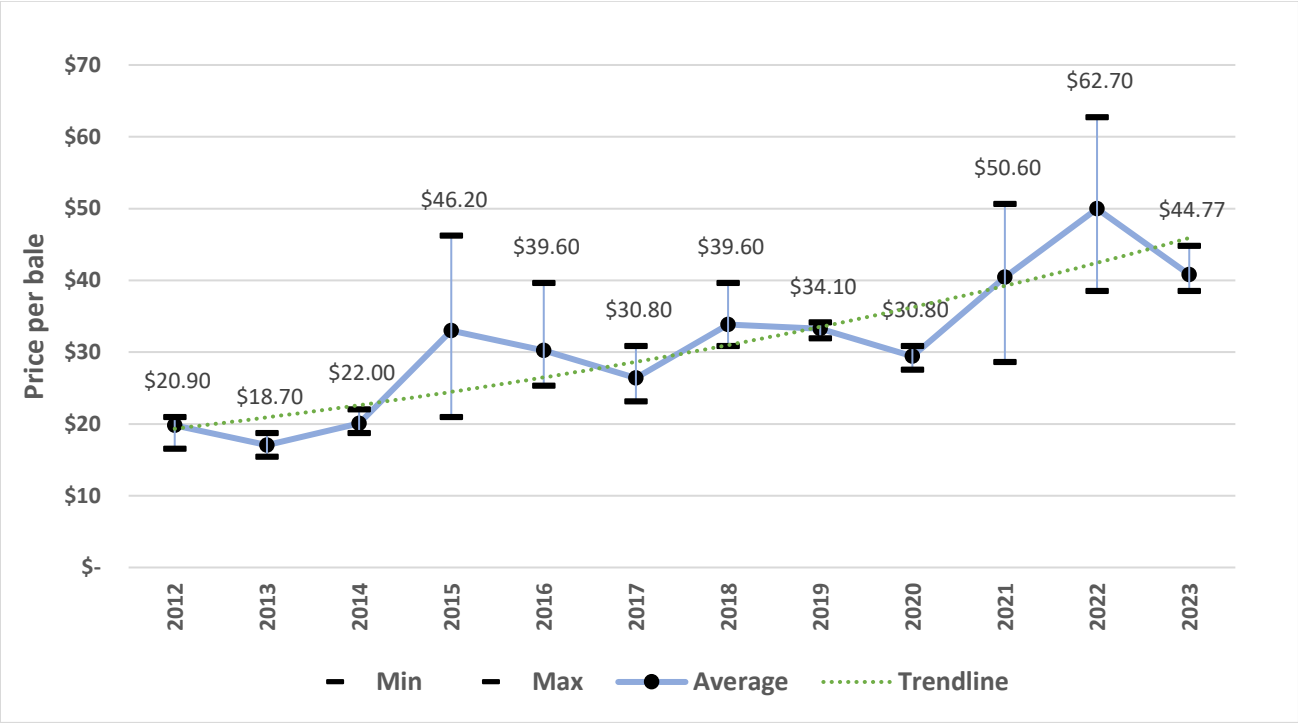
[33] https://www150.statcan.gc.ca/n1/pub/71-607-x/2018016/cpilg-ipcgl-eng.htm

Figure E-2. Historical price of diesel in Edmonton/Calgary AB[34]



[34] www.alberta.ca/system/files/tec-diesel-fuel-cost-adjustment-mar2006-nov2023.pdf

Figure E-3. Historical wheat straw prices ($/bale)[35]



[35] afsc.ca/income-stabilization/agristability/agristability-price-lists/

Map E-1. Alberta's high load corridor highway map.[36]

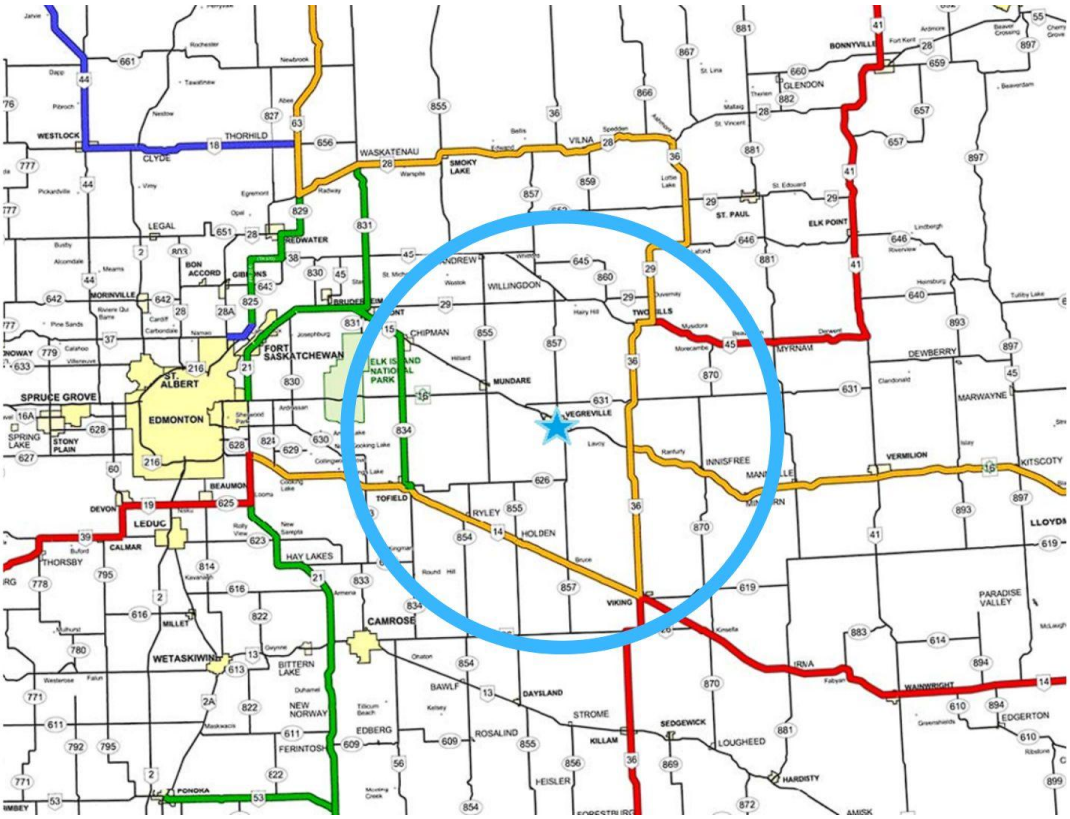


Figure E-4. Prosperity Industrial Park Natural gas service line costs at the industrial park[37]

Service Line Diameter	Summer	Winter
15 mm or 26 mm (up to and including 15 metres) Linear charge for length over 15 metres	$728 $35/metre	$949 $51/metre
42 mm or 60 mm (up to 15 metres) Linear charge for length over 15 metres	$1,340 $79/metre	$1,749 $104/metre
Greater than 60 mm	Contract Price	Contract Price
Credit for provision of service line trench in 4-party installation	$47	$236

[36] https://www.alberta.ca/high-load-corridor
[37] Provided by the Town of Vegreville

Figure E-5. Prosperity Industrial Park – Selected Infrastructure Area



SECTION F: LEGAL DISCLAIMER

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