Biofuel Development Opportunity Zone Rating Flagstaff County, AB
Date of Issue: May 10, 2024
Rating Grade: **'A'**

A
High Quality

Rating Parameters:

Category	Rated Quantity	Delivered Cost	BDO Zone Size
Wheat Straw	**450,000 odt/yr**	**$118-$127/odt**	**120-km drive distance from Forestburg, AB**

BDO Zone Assets

- **450,000 odt per year low-risk wheat straw supply.**
- **Multi-generational history of wheat production and wheat straw harvesting.**
- **Producer willingness to participate in a wheat straw project under sustainable and mutually profitable conditions.**
- **No large wheat straw competitors in the BDO Zone.**
- **Made-in-Alberta farm-restricted Class 1 driver licensing alleviates truck driver shortages and creates local jobs.**
- **A greenfield industrial park with investment ready plan.**

BDO Zone Liabilities

- **Uncertain wheat straw supply due to potential grain price volatility, yield fluctuations, and weather extremes.**
- **Potentially challenging supply chain logistics due to geographical dispersion of farms of various sizes.**
- **Potential public discomfort due to increased truck traffic, noise, emissions levels, road quality degradation, and accident risks.**

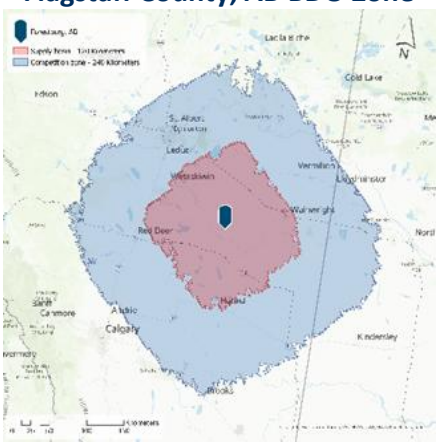
Rating Grade

The Flagstaff County, 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. This capacity may, nevertheless, be more vulnerable to adverse weather, supply chain, economic, or infrastructure conditions than is the case for higher ratings.

Flagstaff County, AB BDO Zone



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 oven-dry tonnes per year (odt/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 (Forestburg, 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. The BDO Zone score for Flagstaff County, AB, is ***19 out of 100, resulting in an 'A' designation.***

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

Analyst Notes

The Flagstaff County BDO Zone is defined by a 120-km drive distance from the Village of Forestburg, AB. The BDO Zone has a total area of 2.8 million hectares and spans over 14 counties, which include small rural farming communities. The most important crops produced in the BDO Zone are wheat, barley, oats, canola, and flax.

Spring wheat is the major crop in the BDO Zone and is generally cultivated under a no-till/no-irrigation practice. Spring wheat is planted on approx. 600,000 hectares annually, on a rotation basis with other crops. In 2016, the latest agriculture census recorded approx. 2,000 wheat farms in the BDO Zone.

The average annual wheat straw production in the BDO Zone was estimated based on the historical 2015-20 average annual wheat grain production to which a straw-to-grain ratio was applied. Then, cattle use, sustainable removal, baling efficiency, and redundancy factors were applied.

We concluded that a new project in Forestburg could have access to 450,000 odt/year of wheat straw at delivered prices between $118 and $127 per odt, or between $52 and $54 per round bale.

Once implemented, a wheat straw project could develop a sustainable supply chain that integrates other existing straw sources, such as barley, oats, canola, and flax.

BDO Zone Assets

Wheat producers in Flagstaff County have had a long, multi-generational history of wheat straw production and collection. Some farms date back to the early 1900s.

Less than 10% of wheat straw generated in the BDO Zone is used for livestock. The remaining 90% is chopped and spread in the field to provide soil stability, moisture retention, and nutrition. No large competitors exist or were announced in the BDO Zone.

Sufficient round baling and transportation equipment is available in the BDO Zone to supply the rated quantity. While the region has experienced an increasing shortage of truck drivers, effective April 1, 2024, eligible farmers and their family members will have the option to apply for a farm-restricted Class 1 driver's licence. This will alleviate the truck driver shortages and create new local jobs in the BDO Zone.

However, investments in high-density square baling equipment will be necessary to reach optimal efficiency. Local producers are willing to invest in more efficient equipment if a profitable wheat straw project is implemented in the BDO Zone.

BDO Zone Liabilities

Historical straw prices in the Northeast Region of Alberta have been volatile. The lack of sustained demand created a spot market that triggers these price fluctuations. A new project will likely result in improved price stability.

The vast majority of the farms (95%) in the BDO Zone are up to 3,500 acres in size, with an average crop

area of 50%. Coordinating harvesting, baling, transportation, and storage within 2-3 months after crop harvesting will require significant logistical efforts.

A project located in the Village of Forestburg will require approximately 120 truck trips per day, which may trigger some public discontent. A mitigation strategy could involve locating the facility as far as possible from the community. The heavy traffic could also be diverted using existing rural roads and planned roads within the industrial park. Public input and agreements will be required before the project is implemented.

Infrastructure Profile

Flagstaff County offers a greenfield location for a new facility in an industrial park with land available for expansion and storage.

The site is a 117-acre greenfield parcel in the proposed Village of Forestburg and Flagstaff County Industrial Park. The Area Structure Plan (ASP) has been completed, and the parcel is zoned Highway Commercial. The ASP includes an environmental site assessment, a geotechnical investigation, a traffic impact assessment, a historical resources overview, and a bio-physical assessment.

All utilities are located at the property line, and the site has access to all modes of transportation.

Proximity to the Village of Forestburg provides relocation and investment incentives due to its safety, access to all levels of education, healthcare, sports, entertainment, housing, and openness to new agri-business developments.

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Figure 1: Risk Indicators (Sorted by Risk Level)

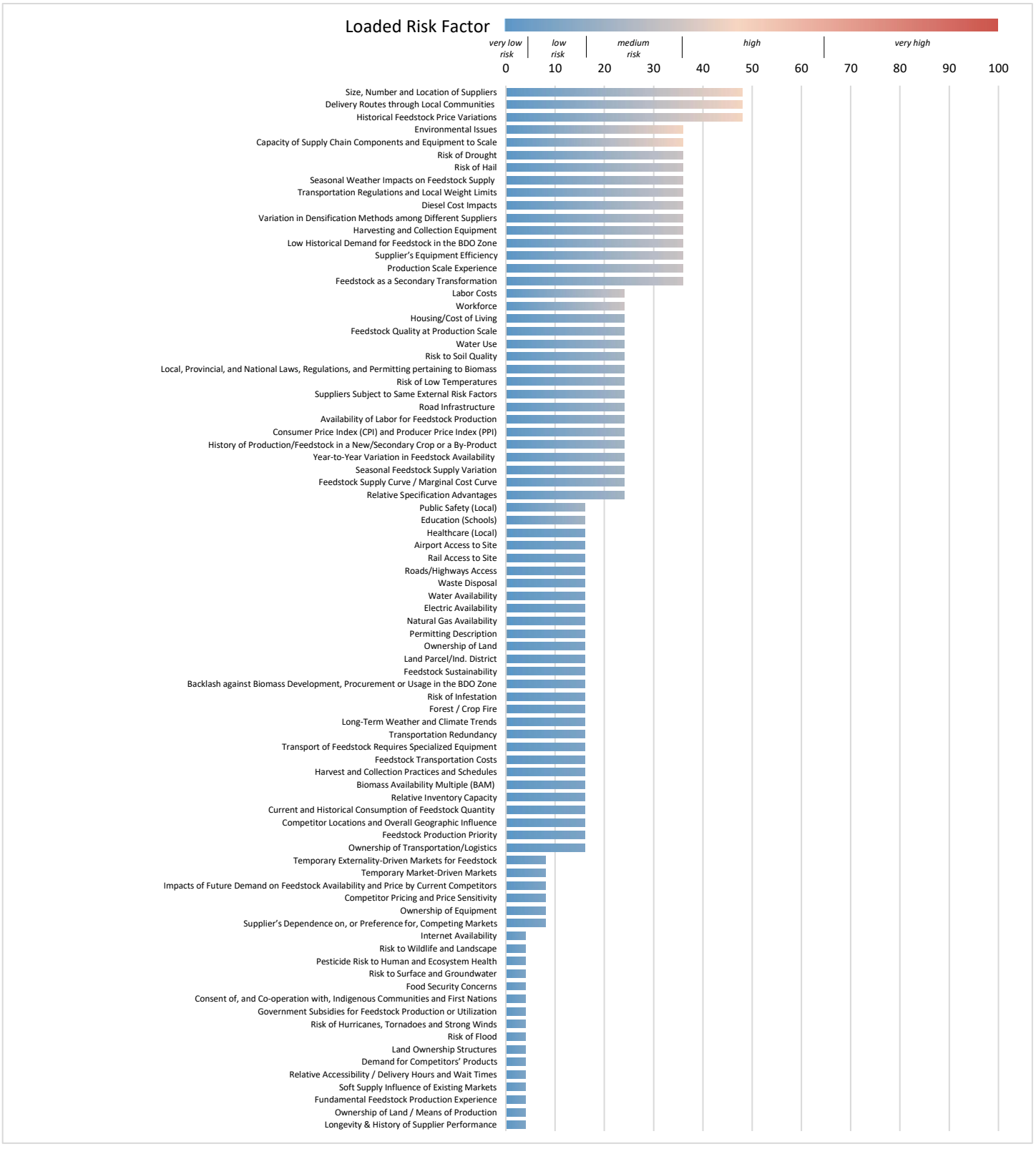


Table 1: Risk Indicators and Associated Scores

	Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
	Category 1.0: Supplier Risk					
1.1.1	Longevity & History of Supplier Performance	2	2	4	NN	4
1.2.1	Suppliers' Dependence on, or Preference for, Competing Market(s)	2	4	8	NN	8
1.3.1	Ownership of Land/Means of Production	2	2	4	NN	4
1.3.2	Ownership of Equipment	2	4	8	NN	8
1.3.3	Ownership of Transportation/Logistics	4	4	16	NN	16
1.3.4	Feedstock as a Secondary Transformation	6	6	36	NN	36
1.4.1	Fundamental Feedstock Production Experience	2	2	4	NN	4
1.4.2	Production Scale Experience	6	6	36	NN	36
1.5.1	Supplier's Equipment Efficiency	6	6	36	NN	36
1.6.1	Feedstock Production Priority	4	4	16	NN	16
	Category 2.0: Competitor Risk					
2.1.1	Competitor Locations and Overall Geographic Influence	4	4	16	NN	16
2.1.2	Current and Historical Consumption of Feedstock Quantity	4	4	16	NN	16
2.1.3	Competitor Pricing and Price Sensitivity	2	4	8	NN	8
2.1.4	Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	2	4	8	NN	8
2.1.5	Soft Supply Influence of Existing Markets	2	2	4	NN	4
2.1.6	Temporary Market-Driven Markets	2	4	8	NN	8
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	6	24	NN	24
2.2.4	Demand for Competitors' Products	2	2	4	NN	4
	Category 3.0: Supply Chain Risk					
3.1.1	Biomass Availability Multiple (BAM)	4	4	16	NN	16
3.1.2	Feedstock Supply Curve/Marginal Cost Curve	4	6	24	NN	24
3.1.3	Seasonal Feedstock Supply Variation	4	6	24	NN	24
3.1.4	Year-to-Year Variation in Feedstock Availability	4	6	24	NN	24
3.2.1	Historical Feedstock Price Variations	6	8	48	NN	48
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	6	24	NN	24
3.3.1	Consumer Price Index (CPI) and Producer Price Index (PPI)	6	4	24	NN	24
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
3.4.1	Harvest & Collection Practices & Schedules	4	4	16	NN	16
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 Labour for Feedstock Production	4	6	24	NN	24
3.5.1	Feedstock Transportation Costs	4	4	16	NN	16
3.5.2	Diesel Cost Impacts	6	6	36	NN	36
3.5.3	Transport of Feedstock Requires Specialized Equipment	4	4	16	NN	16
3.5.4	Delivery Routes through Local Communities	6	8	48	NN	48
3.5.5	Transportation Regulations & Local Weight Limits	6	6	36	NN	36
3.5.6	Road Infrastructure	4	6	24	NN	24
3.5.7	Transportation Redundancy	4	4	16	NN	16
3.6.1	Size, Number, and Location of Suppliers	6	8	48	NN	48
3.6.2	Suppliers Subject to Same External Risk Factors	4	6	24	NN	24
3.6.3	Land Ownership Structures	2	2	4	NN	4
3.7.1	Seasonal Weather Impacts on Feedstock Supply	6	6	36	NN	36
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	6	6	36	NN	36
3.7.6	Risk of Flood	2	2	4	NN	4
3.7.7	Risk of Drought	6	6	36	NN	36
3.7.8	Risk of Hurricanes, Tornadoes, and Strong Winds	2	2	4	NN	4
3.7.9	Risk of Low Temperatures	4	6	24	NN	24
3.8.1	Government Subsidies for Feedstock Production or Utilization	2	2	4	NN	4
3.8.2	Local, Provincial, & National Laws, Regulations, & Permitting pertaining to Biomass	4	6	24	NN	24
3.8.3	Backlash against Biomass Development, Procurement or Usage in the BDO Zone	4	4	16	NN	16
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
3.9.1	Feedstock Sustainability	4	4	16	NN	16
3.9.2	Risk to Soil Quality	4	6	24	NN	24
3.9.3	Risk to Surface and Groundwater	2	2	4	NN	4
3.9.4	Water Use	4	6	24	NN	24
3.9.5	Pesticide Risk to Human and Ecosystem Health	2	2	4	NN	4
3.9.6	Risk to Wildlife and Landscape	2	2	4	NN	4
3.9.7	Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
	Category 4.0: Feedstock Scale-up Risk					
4.1.1	Feedstock Quality at Production Scale	4	6	24	NN	24
4.1.2	Capacity of Supply Chain Components & Equipment to Scale	6	6	36	NN	36
	Category 5.0: 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	6	6	36	NN	36
5.2.1	Natural Gas Availability	4	4	16	NN	16
5.2.2	Electric Availability	4	4	16	NN	16
5.2.3	Water Availability	4	4	16	NN	16
5.2.4	Waste Disposal	4	4	16	NN	16
5.2.5	Internet Availability	2	2	4	NN	4
5.3.1	Roads/Highways Access	4	4	16	NN	16
5.3.2	Rail Access to Site	4	4	16	NN	16
5.3.3	Airport Access to Site	4	4	16	NN	16
5.3.4	Water Freight Access	NR	NR	NR	NR	NR
5.4.1	Healthcare (Local)	4	4	16	NN	16
5.4.2	Education (Schools)	4	4	16	NN	16
5.4.3	Local Transportation	NR	NR	NR	NR	NR
5.4.4	Public Safety (Local)	4	4	16	NN	16
5.4.5	Housing/Cost of Living	4	6	24	NN	24
5.5.1	Workforce	4	6	24	NN	24
5.5.2	Labour Costs	4	6	24	NN	24
					Average	***19***



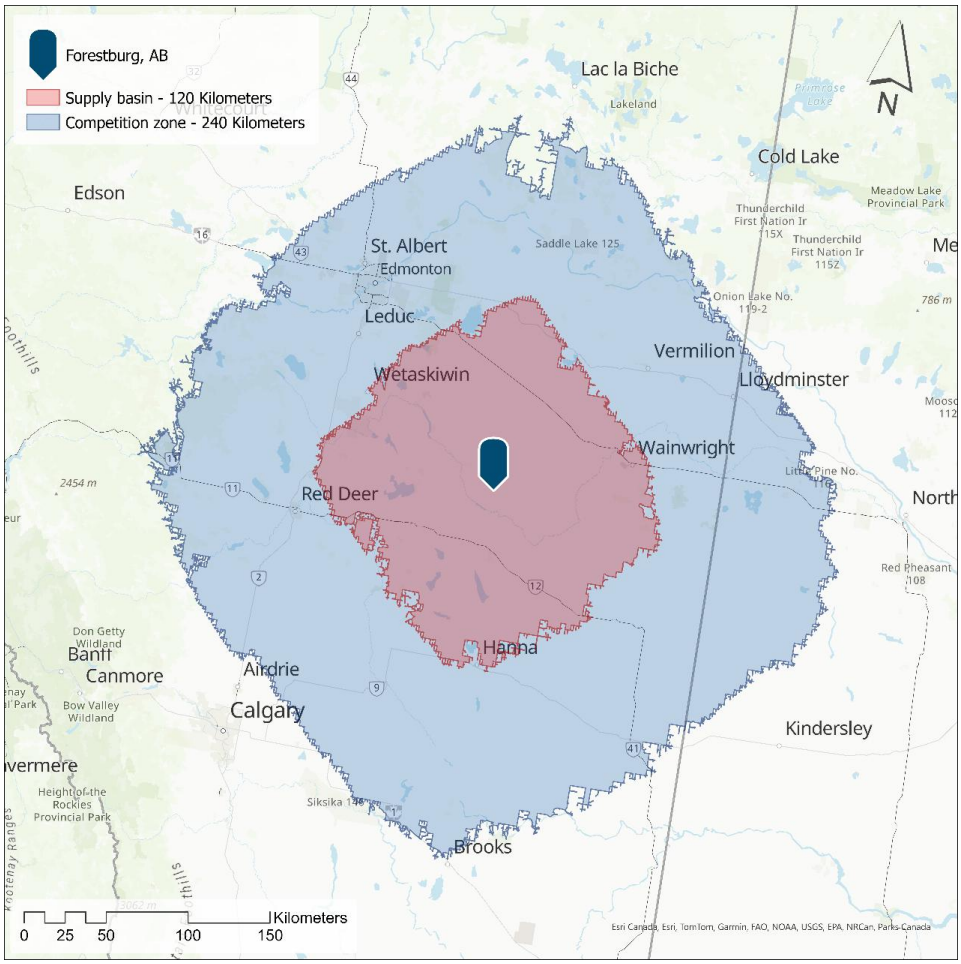
Flagstaff County, AB, BDO Zone Independent Review Committee (IRC)

Jenalee Waring – Economic Development Officer, Flagstaff County
Shaina Dunn – Economic Development Coordinator, Flagstaff County
Jeff Eckstand – County Councilor / Producer, Flagstaff County
Nick Dunn – Agricultural Foreman, Flagstaff County
Khalil Ahmed – Manager & Communication Coordinator, Battle River Research Group
Matt Enright – General Manager, Battle River Railway NGC Inc.
Roger Chevraux – Local Producer
Jason Forster – Local Producer
Mike Kueber – Local Producer
Stuart Carruthers – Local Producer
Dan Skoberg – Local Producer

APPENDIX A: BIOMASS AVAILABILITY AND PRICING

BDO Zone Risk Indicators are scored with reference to rated quantities and prices. Firstly, the rated wheat straw quantity was determined by estimating the potential quantity produced within the BDO Zone (Map A-1) defined by the 120-km drive distance from the Town of Forestburg, AB. Secondly, the potential quantity was reduced based on the expected/estimated demand for wheat straw in the Competition Zone (240-km drive distance from the Town of Forestburg, AB). Thirdly, deductions were applied for sustainable retention, harvesting efficiency, and producer participation rate. Finally, a Biomass Availability Multiple (BAM) reduced the available amount based on supply chain constraints and data/model uncertainties. The resulting rated wheat straw quantity is a conservative, low-risk estimate of wheat straw availability for a new project in Forestburg. The price range associated with the rated quantity was determined through outreach and market analysis in the BDO Zone. The price range reflects the expected price a new bio-project would have to pay to secure the rated quantity.

Map A-1. Map of BDO Zone and Competition Zone with Forestburg as the Centre Point

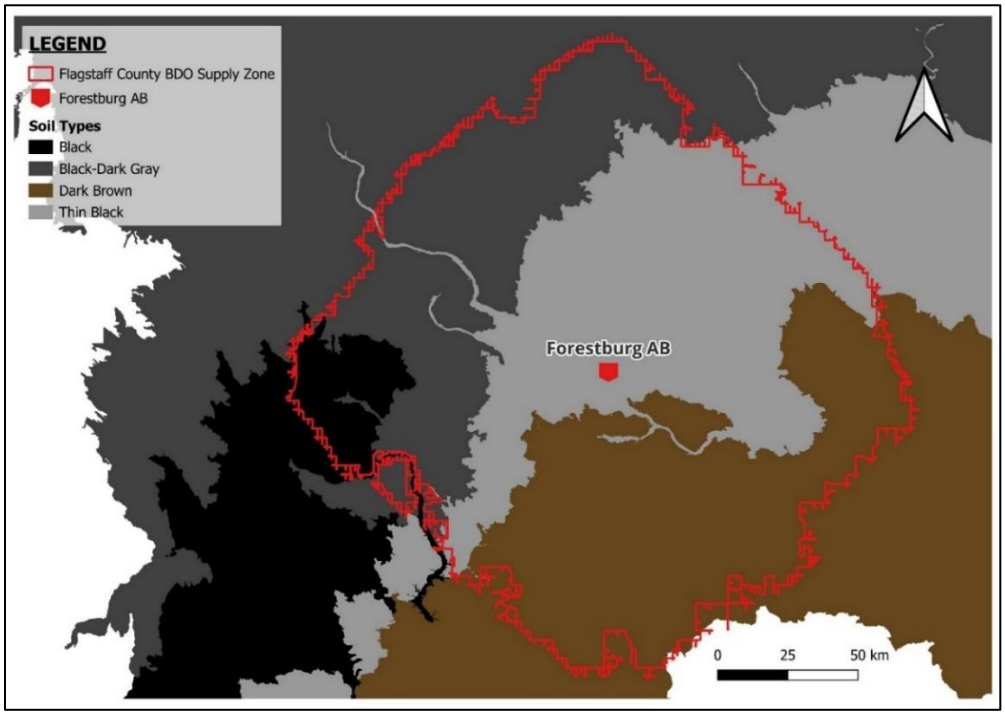


Supply Analysis

The Flagstaff County BDO Zone is located in the central part of the Province of Alberta, Canada. Forestburg is the centre point of the Flagstaff BDO Zone, located approx. 140 km southwest of Edmonton and approx. 200 km northwest of Calgary. The BDO Zone has a total area of 2.8 million hectares and spans over 14 counties, which include small and rural farming communities. The most important crops produced in the BDO Zone are wheat, barley, oats, canola, and flax. The region is also well known for its cattle production. According to the 2016 agriculture census,[1] there were approx. 2,000 wheat farms and approx. 2,700 cattle farms in the BDO Zone. While 95% of the farms are up to 3,500 acres in size and an average of 50% crop area, the trend has been toward small farm fragmentation and larger farm aggregation.

Spring wheat is the major crop in the BDO Zone and is generally cultivated under a no-till/no-irrigation practice. Wheat is planted in the BDO Zone on approx. 600,000 hectares annually, on a rotation basis with other crops. The choice of rotation crops varies depending on the gain in market prices, but wheat has always been an annual crop in the region. Examples of three-year crop rotations in the BDO Zone include canola-wheat-wheat and barley-wheat-wheat. Wheat straw is a byproduct of wheat production that has traditionally been used for animal bedding and soil amendment/nutrition. In dry years, wheat straw was rarely used as fodder mix. Other more nutritional straw choices like barley and oats are preferred. As no other markets for wheat straw exist currently, about 90% of the wheat straw is chopped and spread in the field to provide soil stability, humidity retention, and nutrition. Map A-2 shows the spatial distribution of soil types within the Flagstaff BDO Zone. Approximately 40% of the land is in the dark brown soil type. Outreach to local producers identified the brown soil type as an indicator of farms less likely to participate in a wheat straw collection program due to lower grain/straw productivity and systematic use of wheat straw for soil remediation and protection. Conversely, the farms located in black soil types were deemed more likely to participate in a wheat straw collection program.

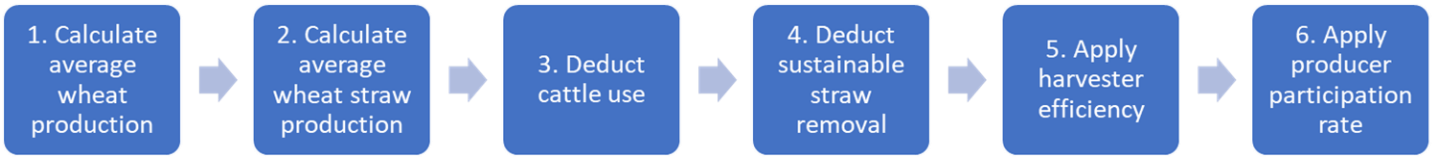
Map A-2. Map of Soil Types in the Flagstaff County BDO Zone



[1] open.alberta.ca/publications/9781460143940 (number of farms adjusted proportional to the area of each county included in the BDO Zone).

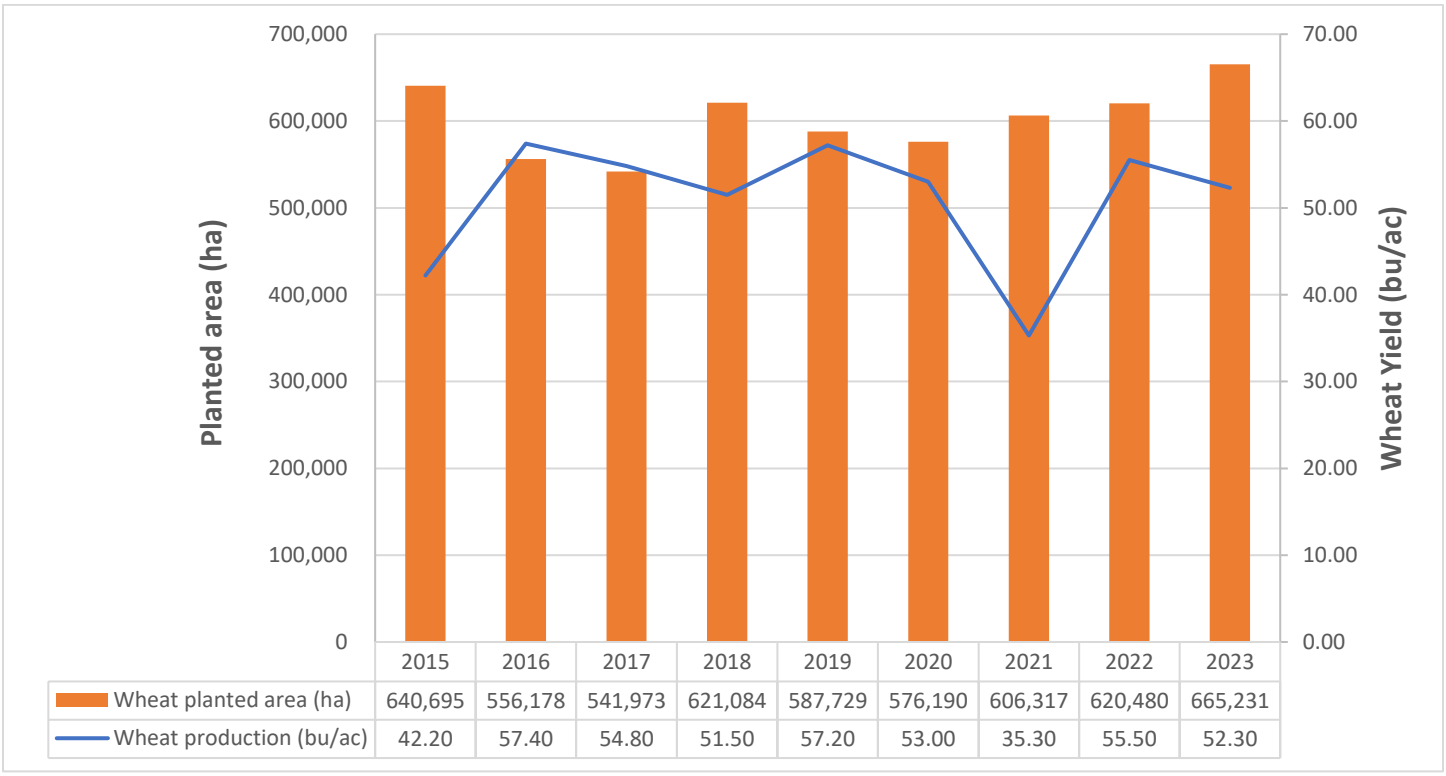
Figure A-1 presents the six steps employed to assess the wheat straw availability in the Flagstaff BDO Zone.

Figure A-1. Wheat Straw Supply Estimation Methodology



Firstly, the historical wheat planted area and yield in the Flagstaff County BDO Zone (Figure A-2) values[2] were used to calculate the average planted area and average yield. Slight variations occurred in planted area over time. However, wheat yields experienced two significant drops in 2015 and 2021 due to drought.[3] These large yield fluctuations indicate a potential high risk of wheat straw supply fluctuations due to weather events, such as droughts.

Figure A-2. Historical Planted Area and Wheat Yield in the Flagstaff BDO Zone



	2015	2016	2017	2018	2019	2020	2021	2022	2023
Wheat planted area (ha)	640,695	556,178	541,973	621,084	587,729	576,190	606,317	620,480	665,231
Wheat production (bu/ac)	42.20	57.40	54.80	51.50	57.20	53.00	35.30	55.50	52.30

[2] open.canada.ca/data/en/dataset/ba2645d5-4458-414d-b196-6303ac06c1c9/resource/328b7503-ed8f-44fa-a60b-0a369cf584b5; www.alberta.ca/alberta-crop-reports
[3] Personal communication with local agronomist.

Table A-1 presents the intermediate and final results of the six-step methodology shown in Figure A-1.

In **Step 1,** the average annual planted area and grain yield values (Figure A-2) generated an annual grain production estimate of approx. 2 million tonnes.

In **Step 2,** an estimated annual straw production of approx. 2.8 million bdt was obtained by applying the straw-to-grain ratio and straw moisture content.

In **Step 3,** the cattle use quantity was deducted. The 10% cattle use is a conservative value generated through outreach to local grain and cattle producers. The resulting wheat straw estimate after cattle use was approx. 2.5 million odt/year.

Steps 4 and 5 significantly reduced the quantity of wheat straw by applying sustainable straw removal and harvesting efficiency factors. The sustainable straw removal factor ensures that, on average, the annual removal of wheat straw does not negatively affect soil health in the long term. This value was obtained through a literature review and outreach to local producers and experts.

In **Step 6,** a producer participation rate of 60% was applied and justified by the black soil type coverage in the BDO Zone (Map A-2) and outreach to local producers and experts. The resulting annual wheat straw availability was estimated to be approx. **500,000 odt/year**.

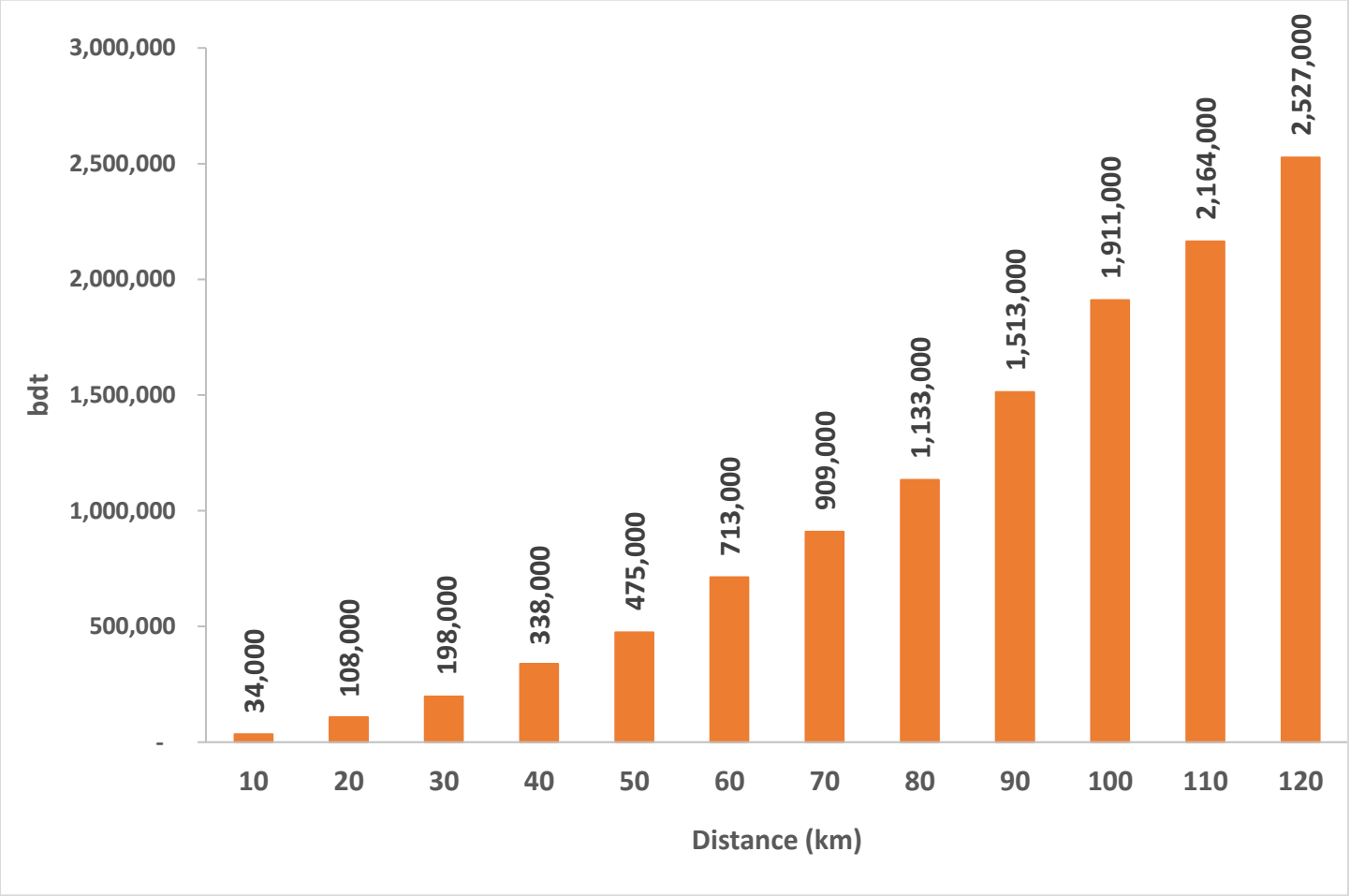
Table A-1. Annual Wheat Straw Availability Calculation

Step 1	Average annual planted area (ha)	601,764
	Average annual grain production (bu/ac)	51.02
	Average annual grain production (tonnes/ha)[4]	3.43
	Average annual grain production (tonnes)	**2,064,817**
Step 2	Straw/Grain Ratio[5]	1.6
	Average wheat straw moisture content (wet basis)[6]	15%
	Average annual straw production (odt)	**2,808,151**
Step 3	Cattle use (%)[7]	10%
	Available annual quantity after cattle use (odt)	**2,527,336**
Steps 4 & 5	Sustainable straw removal (%)[8]	40%
	Harvester efficiency (%)	82%
	Sustainably removed quantity (odt)	**828,966**
Step 6	Producer Participation (%)	60%
	Annual straw availability (odt)	**497,380**

To better understand the availability of wheat straw at 10-mile distance increments from Forestburg, a supply curve was constructed for the total available quantity except for the 10% cattle use (Figure A-3). The graph indicates that approximately half of the wheat straw quantity is located up to 80-km drive distance from Forestburg, AB.

[4] 1 ha = 2.471 acres; 1 bushel of wheat = 36.744 tonnes.
[5] 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.
[6] 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).
[7] Personal communications with local producers. This is an average value. The actual value varies depending on wet or dry years. More straw is retained for cattle in dry years than in wet years.
[8] infosys.ars.usda.gov/WindErosion/publications/Andrew_pdf/Soil%20Conservation%20Limitations-Energy%20Production.pdf

Figure A-3. Estimated Wheat Straw Quantities by Distance from Forestburg, AB*



* Cattle use quantities were deducted.

Competition Analysis

Our literature review and outreach revealed that, except for the 10% cattle use that was already discounted from the total wheat straw availability (Table A-1), **no established competition exists for the rated quantity of wheat straw** in the Flagstaff BDO Zone.

Rated Quantities and Pricing

Table A-2 shows the result of applying a Biomass Availability Multiple (BAM) to the wheat straw estimate in Table A-1. BAM allows for a conservative quantity redundancy that ensures confidence to investors that the project-ready estimates are realistic, credible, and achievable. A BAM of 1.1 was selected to account for uncertainty in the accuracy of existing data, scale-up readiness, historical harvesting practices and volumes, and sudden changes in wheat straw production and demand. The resulting rated quantity of **450,000 odt/year** represents **16% of the total** estimated wheat straw production in the Flagstaff BDO Zone. This percentage confirms a conservative rated quantity estimate that is in tune with local producers' feedback. However, this percentage is expected to increase once a mutually beneficial project is implemented. Producers indicated that the participation rate and delivered quantities will depend on pricing strategies, including the

extra costs incurred at the farm level and a reasonable profit margin. Most importantly, they expect to be compensated for the nutrient replacement value of the wheat straw.

Table A-2. BAM and Rated Quantity of Wheat Straw

Annual straw availability (odt)	497,380
BAM	1.1
Rated Quantity (odt)	**450,000**
Removal % from total	**16%**

The delivered price range for the rated quantity of wheat straw was estimated employing the formula presented in Figure A-4.

Figure A-4. Price Estimation Methodology



The following assumptions/values were used to estimate the **price at the farm gate**:

- Bale average moisture content: 15% (wet basis)[9]
- Bale average weight: 1,100 lbs or 0.42 odt
- Baling/Moving/Staking costs: $15/bale for baling + $2/bale for moving/stacking at field side[10]
- Producer's markup: 15%
- Storage costs were not included in the price as assumed to be borne by the client/project.

The **nutrient replacement value** of wheat straw was calculated[11] using the current fertilizer prices and average nutrient contents of straw[12] presented in Table A-3. The resulting nutrient replacement value was **$35/odt**, or **$17/bale** (Table A-4).

Table A-3. Fertilizer and Nutrient Prices (2024)

Fertilizer Type	**Price** ($/tonne)	**N** (lbs/tonne)	**P** (lbs/tonne)	**K** (lbs/tonne)	**S** (lbs/tonne)	**N** ($/lb)	**P** ($/lb)	**K** ($/lb)	**S** ($/lb)
Nitrogen (urea) 46-0-0	$959	16.70				$0.78			
Phosphorus 11-52-0	$1,149		1.70				$1.00		
Potash 0-0-60	$712			22.40				$0.54	
Sulphur 20.5-0-0-24	$595				3.00				$1.12

[9] 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
[10] Personal communications with local producers and experts
[11] open.alberta.ca/dataset/690317b0-1d07-4f9e-ae71-6340e16f6493/resource/89789096-1c7a-47ab-beb2-94d55606c922/download/af-straw-manufacturing-in-alberta-2020-01.pdf
[12] Fertilizer prices: Personal communications with local applied research expert; www.agric.gov.ab.ca/app21/farminputprices (last accessed April 2, 2024); www.albertagrains.com/files/2022/09/straw_management_in_western_canada_wheat_and_barley_cropping_systems.pdf.

Table A-4. Straw Nutrient Replacement Value

Nutrient Replacement Value	$/odt	$/bale
N	$15	$7
P	$2	$1
K	$14	$7
S	$4	$2
Total Straw Nutrient Replacement Value	**$35**	**$17**

The following assumptions/values were used to calculate the **transportation cost**:

- 34 round bales (1,100 lbs each) per load transported on 53-ft flatbed trailers[13]
- Transportation cost (loaded and empty): $150/hr[14]
- 1 hr loading/unloading time (included in the $150/hr transportation cost)
- 80 km/hr average speed

Table A-5 shows the estimated cost of **$31/odt**, or **$13/bale,** to transport wheat straw from an average of 80 km driving distance to Forestburg. For transportation costs between 10 km and 120 km driving distances in 10 km increments, refer to Figure C-1 in Appendix C.

Table A-5. Transportation Cost Calculation

Equipment	53 ft flatbed trailer
Average bales per load	34
Average Bale Weight (lb)	1,100
Average load weight (odt)	14.4
Average travel speed (km/h)	80
Average load/unload time (hr)	1
Transportation rate ($/hr)	$150
Transportation cost to 80 km ($/odt)	**$31**
Transportation cost to 80 km ($/bale)	**$13**

Table A-6 shows the wheat straw **calculated price at the farm gate** of **$87/odt**, or **$39/bale**, which included baling/moving/staking costs, nutrient value, and 15% producer markup. The current local spot price range of **$30-$35/bale**[15] suggests that the nutrient value is not fully included. Thus, the calculated farm gate price was used in the price range estimation to account for the full nutrient value. In addition, the historical straw market price records in the Northeast Region of Alberta (Figures C-3 and C-4 in Appendix C) show that, in 2023, the average price of straw was **$96/odt**, or **$41/bale**. The 2023 average price was also used in the price range estimate (Table A-7).

[13] open.alberta.ca/publications/1701-2759
[14] Personal communications with local transportation provider
[15] farmingtheweb.ca/listings/728; Kijiji

Table A-6. Farm Gate Price

Price Component	$/odt	$/bale
Baling/Moving/Stacking cost	$40	$17
Nutrient replacement value	$35	$17
Producer markup (15%)	$11	$5
Calculated price at farm gate	**$87**	**$39**

Table A-7. Delivered Price Range

Price Component	$/odt	$/bale
Price range at farm gate	$87-$96	$39-$41
Transportation cost to 80 km	$31	$13
Delivered price range	**$118-$127**	**$52-$54**

In conclusion, the rated quantity of wheat straw was **450,000 odt/yr** (Table A-2), and the delivered price range for round wheat straw bales was estimated to be **$118-$127/odt**, or **$52-$54/bale** (Table A-7).

If a new project located in Forestburg utilized the rated quantity of wheat straw, approximately 175 balers (round bales), 350 tractors,[16] and 30 trucks with 53-ft flatbed trailers[17] would be necessary. Local producers and experts communicated that this level of equipment was achievable in the BDO Zone. This claim was confirmed by the 2016 Census,[18] which reported approx. 18,500 tractors and 4,350 balers in the BDO Zone.

While the above equipment requirements seem achievable under the current equipment availability, a large-scale wheat straw project would most likely require improved baling and transportation efficiency. Consequently, investments in high-density square baling equipment may be necessary to significantly increase this efficiency. Producers communicated their willingness to invest in large square balers if a feasible wheat straw project is implemented in Forestburg. Three agricultural equipment dealerships are located in Flagstaff County, and many others are present in the region.

Custom transportation capacity exists in addition to the local small/medium scale transportation equipment (i.e., pickup trucks and trailers).[19] While the region has experienced an increasing shortage of truck drivers, effective April 1, 2024, eligible farmers and their family members will have the option to apply for a farm-restricted Class 1 driver's licence.[20] This will alleviate the truck driver shortages and create new local jobs in the BDO Zone. Another challenge is the increased truck traffic in/near the Forestburg area. This could lead to increased risk of accidents, poorer road quality, and increased noise and emission pollution.

Outreach revealed that the workforce was available at the farm level but some training was still needed with new employees. Producers are also pleased with the prospect of increased profit and job opportunities in the BDO Zone. Also, curtailments have been occurring at the coal mines near Edmonton due to coal power plants switching to natural gas.[21] The available skilled labour may be enticed to participate in a wheat straw project in the BDO Zone.

[16] Assuming 2 tractors: one for the baler and one for the bale collector at 10-hr day x 40 harvest days per year x 15 bales/hr (baler productivity assumed based on outreach of local producers).
[17] Assuming the same configuration as in Table A-5 and an average 4 trips/day for 240 days/year.
[18] open.alberta.ca/publications/9781460143940 (the 2016 Census data was adjusted based on the area of each county included in the BDO Zone).
[19] Personal communication with local producers.
[20] www.alberta.ca/farm-restricted-class-1-drivers-licence
[21] calgaryherald.com/business/energy/coal-power-disappearing-alberta-grid.

Flagstaff County has previous experience supplying larger quantities of wheat straw. In 2000, a strawboard plant operated in Forestburg for six months and employed 15 residents. The plant and supply chain were co-financed by local investors, many of whom were crop producers. The project supplied large, high-density square balers. Bales were transported and stored in a large shed at the factory. No offtake agreements were made with local producers. The plant closed down due to alleged management and technical challenges. Accidental storage fires were also reported.

This failed project left a lingering memory in the community for years. However, outreach indicated that the unpleasant memory has almost completely faded.[22] The positive outcome is that local producers demonstrated that they were capable of sustaining a large-scale straw project in Forestburg. Outreached confirmed that the capacity to support a large straw project, while currently dormant, is waiting for the right project to be released.

[22] Information about the former strawboard plant in Forestburg was gathered from several local witnesses who were involved in the project.

APPENDIX B: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

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

1.1.1 Longevity & History of Supplier Performance

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

Risk Information: Wheat producers in Flagstaff County have a long, multi-generational history of wheat straw production and collection. Some farms started in the early 1900s. According to the 2016 agriculture census, there were approx. 2,000 wheat farms and approx. 2,700 cattle farms in the BDO Zone. Also approx. 18,500 tractors and 4,350 balers were reported in the BDO Zone.[23]

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: Only less then 10% livestock demand for wheat straw exists in the BDO Zone. This percentage may increase in years with less precipitation when less straw is available. The remaining portion (90%) of the wheat straw quantity is chopped and spread in the field to provide soil stability, moisture retention, and soil nutrition. No competitors have been identified or announced to enter the BDO Zone.

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**

[23] open.alberta.ca/publications/9781460143940.

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

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: All croplands in the Flagstaff BDO Zone are privately owned, and the crop growers manage their own wheat straw production and use. The risk is therefore deemed very low.

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**

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: Approx. 18,500 tractors and 4,350 balers were reported in the BDO Zone in 2016. The most popular baling equipment is for round bales and is owned mostly by cattle farmers. Custom baling and transportation are also

employed in the BDO Zone. Producers indicated willingness to invest in new, more efficient, equipment if a feasible project was implemented. There are three agricultural equipment dealers in the BDO Zone. Risk is low.
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** *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 8 out of 100. **8**

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: For decades, the BDO Zone has been a very well-organized agricultural network of producers, custom harvesting, and transportation operations. Outreach indicated no challenges for producers using both their own transportation equipment (pickup trucks and trailers) or custom transportation companies in the region. The expectation is, however, that the project entrant would organize the transportation and storage logistics. Risk is low.
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**

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. There is a strong and reliable history of wheat production in the BDO Zone and wheat prices have supported this steady production (Figure C-2 in Appendix C). Slight but not significant variations occurred in wheat planted areas over the past ten years (Figure A-2). The wheat yields, however, experienced two significant drops in year 2015 and 2021, due to drought. Yield fluctuations due to weather events are expected to continue, thus affecting the sustainability of supply. In addition, in dry years, cattle producers may tap more into the wheat straw supply for bedding and sometimes fodder mix. However, this situation can be mitigated by long-term storage and by expanding the supply area beyond the 120 km distance to access more volumes at higher transportation costs (Figure C-1). The above considerations triggered a medium risk score.

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**

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: See 1.1.1. Wheat producers in Flagstaff County have a long, multi-generational history of wheat straw production and collection. While crop producers are less experienced in harvesting straw than cattle producers who bail their own straw, they are very familiar with the process. We foresee very low risk associated with supplier wheat straw harvesting experience.

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**

1.4.2 Production Scale Experience

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

Risk Information: Harvesting wheat straw is a well-established activity in the BDO Zone. However, scale-up will require increased equipment and labour levels, and significant improvements in harvesting and transportation efficiencies. It was performed at similar levels in the early 2000s when a wheat straw panel board plant operated in Forestburg for 6 months. However, it utilized a high-efficiency supply chain with high-density square balers, which is not the current practice in the BDO Zone. The need for scale-up efforts points to a medium risk score for this indicator.

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.	**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 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: If a new project located in Flagstaff County, AB was able to utilize the rated quantity of wheat straw, approximately 175 balers, 350 tractors, and 30 trucks with 53 ft flatbed trailers would be necessary to supply this amount. While the above requirements seem achievable under current equipment and labour availability, a large-scale wheat straw project would most likely require improved levels of baling and transportation efficiency. Consequently, investments in high-density square baling equipment will be necessary to double or even triple the baling and transportation efficiency. Producers communicated their willingness to invest in large square balers if a feasible, long-term agreement was drafted with the project proponents. Due to significant scale-up equipment requirements, a medium risk was assigned to this indicator.

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**

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: Several factors may affect a producer's willingness to sustainably supply wheat straw to a project in Forestburg. Such factors range from severe weather events to cattle use and soil protection. However, the rated quantity represents only 16% of the total wheat production, which alleviates any concerns of supply instability. Moreover, producers indicated that they were willing to participate in a project as long as a financial benefit that

included the nutritional value was available, which was included in the rated wheat straw pricing. The risk was deemed low.

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**

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: Other than the 10% conservative cattle use estimate, no other competing uses were identified in the Competition Zone. While local newspaper articles allude to the opening of strawboard plants in the region, none has moved to construction phase. Therefore, the risk is low for this indicator.

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**

2.1.2 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: Cattle use for bedding has been the historical use of wheat straw. Some small quantities were used for cattle feed mix, but better alternatives like barley and oat straw exist. A strawboard plant used to operate in Forestburg in 2000, but closed down after 6 months. No significant competition existed in the region. Thus, the risk was deemed low.

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**

2.1.3 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 behaviours 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 estimated farm gate price range of $39-$41/bale is conservative, within the range between the current local spot price of $30-$35/bale and the price trend generated from historical market price records (Figures C-3 and C-4 in Appendix C). Since there is currently no significant competitor for wheat straw in the BDO Zone that could control pricing, this risk was deemed low. However, new projects should consider the price forecasts and undertake a rigorous market analysis before any price agreement (if any) is signed.

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

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: The current use of wheat straw in the Flagstaff County BDO Zone is for cattle. Outreach suggested that the current estimate of 10% utilization is a conservative value and that large increases are not expected. No other large competitors exist or were announced. Thus, the risk was deemed low.

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

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: No such influences were observed or communicated. In the calculation of the rated quantity, both the current competition and the BAM factor (redundancy in the wheat straw supply) were considered. We expect that any temporary supply shortage would not have a significant impact on future wheat straw projects. Consequently, a very low risk was assigned to this indicator.

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**

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.[24]

Risk Information: Despite its low nutrient value, wheat straw could be used as feed during hay shortages. However, the demand increase should not be significant as the wheat straw requires further treatment to increase its palatability and nutritional value. Moreover, it can be easily substituted with barley straw which is softer, has a higher nutritional value than wheat straw, and is readily available in the BDO Zone. As Figures C-3 and C-4 indicate, straw prices can vary throughout the year, but no significant supply risk exists for a new project. Consequently, a low risk was assigned to this indicator.

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**

[24] Bergtold, 2018.

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**

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: Cattle use is under 10% of total wheat straw use in the BDO Zone. Even if cattle producers decided to store larger quantities of wheat straw, it would unlikely have a long-term effect on wheat straw prices. The new project can mitigate such a risk by storing sufficient quantities of wheat straw in satellite storage sites. Consequently, the risk was deemed low.

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**

2.2.2 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: No alternative market exists for wheat straw. Thus, we do not expect there will be an advantage among the existing and future end users of wheat straw in terms of accessibility and delivery hours. A very low risk was attributed to this indicator.

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**

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: While there are no current large-scale competitors for wheat straw in the BDO Zone, a new entrant most likely would target the following quality attributes: moisture content, soil contamination, and bale size/bulk density. Since the current practice of supplying round bales for cattle bedding does not require strict quality standards, it will be necessary for the project proponent to implement a quality control (QC) program for harvesting and collection operations. However, such a program is unlikely to add a significant burden on crop producers to remove their wheat straw. Assuming such a QC program was implemented, the likelihood risk of supplying low-quality wheat straw bales was deemed low and the impact risk moderate.

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**

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: As the current user of wheat straw, the cattle industry is not expected to expand in the BDO Zone. In addition, they use less than 10% of wheat straw production in the BDO Zone. No large-scale competitors exist in the BDO Zone. Risk was deemed very low.

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 low BAM of 1.1 was selected to account for uncertainty in the accuracy of existing data, scale-up readiness, historical harvesting practices and volumes, and sudden changes in wheat straw production and demand. The resulting rated quantity of 450,000 odt/year represents 16% of the total estimated wheat straw production in the Flagstaff BDO Zone. This percentage indicates a conservative estimate that is in tune with local producers' feedback. It is expected, however, that this percentage will increase once a mutually beneficial project is implemented. Consequently, the above considerations led to assigning a low-risk score to this indicator.

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**

3.1.2 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 (Figure A-3) was constructed for the total wheat straw availability (minus cattle use) to better understand the availability at 10-km drive distance increments from Forestburg, AB. The graph indicated that approximately half of the total wheat straw quantity and the entire rated quantity (450,000 odt) is located up to 80-km drive distance from Forestburg, AB. Project proponents will most likely attempt to capture wheat straw supply from within the 80-km drive distance area to reduce transportation costs. As there is no certainty that project proponents will be able to access the rated quantity from this area, the risk is deemed low to moderate.

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**

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

Risk Information: On average, the straw harvesting/baling season spans over approx. 40 days in the fall. The straw collection and baling season can be reduced significantly due to extended periods of rain. However, large scale supply chains extend over large areas, capitalizing on optimally designed logistics of harvesting, storage, and transportation. Timely and proper bale storage prevents biomass deterioration and fire hazards. The above considerations and limitations triggered a low to medium risk assignment to this 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 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)* 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**

3.1.4 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: Historical wheat yield data (Figure A-1) in the Northeast Region of Alberta indicated two significant drops in 2015 and 2021, due to drought. The 2021 wheat crop was a 10-year low due to extreme drought. These large yield fluctuations indicate a high risk of weather events, such as droughts, to reduce the wheat straw supply. However, this risk can be mitigated by increasing participation rates, proper inventory management, and reaching out to farms outside the Supply Zone. There is also a long history of straw baling in the region. The baling equipment is proven, and equipment operators are experienced. Also, large quantities of wheat straw are produced in the BDO Zone; the rated quantity represents only 16% of the total wheat straw production. The above considerations trigger a low to medium risk to this 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 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**

[25] Golecha & Gan, 2016.

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**

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: Historical straw prices in the Northeast Region of Alberta have been fluctuating significantly both between years and within each year (Figures C-3 and C-4). For example, in 2023 the average price was $96/odt, or $41/bale, while in 2022 the average price was $118/odt, or $50/bale. In 2022, the price varied between $91/odt and $148/odt, or between $39/bale and $63/bale. Such price variations are due to the lack of established markets as local users buy straw from the spot market. These are significant price variations that a new project will have to mitigate through proper inventory management and building long-term supply relationships with local growers. Thus, the risk score was elevated to medium-high.

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**

3.2.2 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: As already presented in this rating, harvesting wheat straw is a well-established activity in the BDO Zone. However, the current supply chains have been developed to meet the demands of the local cattle industry, which is currently the only user of wheat straw. To support a large-scale biomass project, scale-up will require increased equipment and labour levels, and significant improvements in harvesting and transportation efficiencies. Producers in the area have the experience of the early 2000s when a wheat straw panel board plant operated in Forestburg for 6 months. However, it utilized a high-efficiency supply chain with high-density square balers, which is not the current practice in the BDO Zone. Consequently, the risk was set to a medium 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**

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: There is a multi-generational experience growing wheat crops and baling straw in the area. Some challenges may exist with scale-up, as described above. Overall, a low to medium risk was assigned.

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**

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: Biomass project developers consider changes in goods and services prices due to factors such as inflation and changes in interest rates in their business models. However, temporary significant rises in CPI and PPI, as seen in 2020-2022 due to the pandemic and global supply chain destructions, can have a medium impact on the biomass delivery prices, but we expect the CPI and PPI to reach a steady status as the economic situation is gradually improving. Figures C-6 and C-7 suggest a medium risk/low impact rating due to some fluctuations in both CPI and PPI in the past 5 years.

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

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.[26]

Risk Information: Wheat straw is not the first choice for animal feed in the region. Cattle producers prefer barley straw, which is softer and has a higher nutritional value than wheat straw. Risk of significant substitution is low.

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**
RRL Mitigation (Notch)	NN
No adjustment.	
RRI Mitigation (Notch)	

[26] Bergtold, 2018.

No adjustment. 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 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: While unpredictable severe weather events have occurred, harvesting wheat straw has followed a consistent schedule, which takes place during and after grain harvesting. Crop growers harvest grain and straw when both the crop and field harvesting conditions are favourable. The risk was set to low for this 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**

3.4.2 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: As presented in 3.2.2, harvesting wheat straw is a well-established activity in the BDO Zone. However, scale-up will require increased equipment and labour levels, and significant improvements in harvesting and transportation efficiencies. Producers in the area have the experience of the early 2000s when a wheat straw panel board plant operated in Forestburg for 6 months. However, it utilized a high-efficiency supply chain with high-density square balers, which is not the current practice in the BDO Zone. A medium risk was deemed for this indicator.
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**

3.4.3 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.[27]
Risk Information: The rated quantity and costs reflect supplying round bales to a large-scale wheat straw project located in Forestburg. However, improved levels of baling and transportation efficiency will be required by a new project. Consequently, investments in high-density square baling equipment will be necessary to double or even triple the baling and transportation efficiency. Producers communicated their willingness to invest in large square balers if a feasible, long-term agreement was drafted with the project proponents. However, risk is elevated to moderate to account for this uncertainty.
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.

[27] Huhnke, 2018.

RRI Mitigation (Notch) No adjustment. 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 36 out of 100.	**Score** **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: Local producers and experts communicated that the level of equipment and labour to supply the rated quantity was achievable. Custom transportation capacity exists in addition to the local small/medium scale transportation equipment (i.e., pickup trucks and trailers). Outreach revealed that workforce was available at the farm level and that some training may be required. Moreover, producers were satisfied that a prospective project would increase profit and job opportunities in the BDO Zone. Also, skilled labour may become available for a wheat straw project in the BDO Zone as curtailments at the coal mines near Edmonton have occurred due to coal power plants switching to natural gas. Risk was deemed low to moderate to account for securing an appropriate level of skilled labour in a timely manner.

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)* 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**

3.5 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: Transportation cost accounts for 22-25% of the total wheat straw delivered price (Table A-7). Figure A-3 indicated that half of the wheat straw production was located within 80-km driving distance. Significant cost reductions can be achieved if the project can secure most of the wheat straw volume from this area. The national and regional shortage of Class 1 drivers is mitigated by the Alberta newly legislated farm-restricted Class 1 drivers' license; thus, risk is low.

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**

3.5.2 Diesel Cost Impacts

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

Risk Information: The price of diesel almost doubled since pre-COVID-19 years (Figure C-5), but fuel prices have stabilized in recent months. While the current average transportation cost in the BDO Zone is approximately $150/hr, this value may increase significantly due to fuel cost increases. In addition, climate change initiatives at all levels (global, national, and provincial) could lead to a steep increase in carbon taxes. The Province of Alberta, however, has instituted a Fuel Tax Relief program that is adjusted quarterly depending on the average price of a barrel of West Texas Intermediate (WTI) oil.[28] Due to this level of price control at the provincial level, the risk is deemed moderate.

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)*	**NN**

[28] https://www.alberta.ca/about-fuel-tax

No adjustment. 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 36 out of 100.	**Score** **36**

3.5.3 Transportation of Feedstock Requires Specialized Equipment

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

Risk Information: Bale transportation does not require specialized equipment. It is most commonly accomplished using 53 ft flat bed trailers and B trains, both available in the region. Thus, the risk was set to low.

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**

3.5.4 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: To deliver the rated annual quantity of wheat straw to Forestburg, it will require approximately 120 truck trips per day.[29] The location of the Forestburg industrial site is just south of highway 53 from the Forestburg community and increased truck traffic may cause discontent among residents. Public input will be required before the project is implemented. A mitigation strategy could be to locate the facility on the most southern part of the industrial park and divert truck traffic using Range Road 151 (from the east), 152 (from the south), and existing/planned industrial roads within the industrial park. Since public discontent with heavy traffic and pollution could stop a project, the risk was deemed moderately high.

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)	**Score**

[29] Assuming an average of 4 trips/day/truck for 30 trucks.

The Gross Risk Indicator (RRL X RRI) is 48 out of 100.	**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**

3.5.5 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: Outreach indicated that increased heavy traffic from agricultural and oil transportation have negatively affected the road pavement conditions. Periodic weight restrictions are imposed but are managed well by local agriculture-related traffic. However, the project may still be negatively affected by road conditions and restrictions given the large number of truck trips throughout the year. Consequently, the risk level was elevated to medium.

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**

3.5.6 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: As presented above, road quality is deteriorating as heavy traffic has increased in the past few years. However, an appropriate road network of both paved and gravel roads exist. A low to medium risk level was considered appropriate for this 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)	**Score**

The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL 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**

3.5.7 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: Local producers and experts communicated that redundancy exists to supply the rated quantity. Custom transportation capacity exists in addition to the local small/medium scale transportation equipment (i.e., pickup trucks and trailers). Risk was deemed low.

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**

3.6 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: According to the 2016 agriculture census, there were approx. 2,000 wheat farms and approx. 2,700 cattle farms in the BDO Zone. The vast majority (95%) of the farms in the BDO Zone are up to 3,500 acres in size, with an average of 50% of farm areas used for crops. Coordinating harvesting, baling, transportation, and storage within 1-2 months after crop harvesting will require significant logistical efforts. Thus, the risk was deemed moderate-high.

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**

3.6.2 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: Farms are uniformly distributed within the BDO Zone and productivity varies with soil type (Map A-2). The primary external risk factor that has been observed in the past ten years was drought, which took place in 2015 and 2021. However, significant redundancy has been built into the model to address supply fluctuations. Single risk events can be mitigated within the geography of the BDO Zone by setting up satellite storage yards at optimal distances from each other and Forestburg. Risk was deemed low-medium.

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**

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: All agricultural lands in the BDO Zone are privately owned and the crop growers have managed their wheat and straw production well. Risk was deemed very low.

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**

3.7 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: Historical wheat yield data in the Northeast Region of Alberta (Figure A-1) indicated two significant wheat yield drops in 2015 and 2021, due to drought. The 2021 wheat crop was a 10-year low due to extreme drought. These large yield fluctuations indicate a high risk of weather events, such as droughts, to reduce the wheat straw supply. Also, extreme hail events have been reported by local producers which compromised a large portion of their crops. However, this risk can be mitigated by increasing participation rates, reaching out to farms outside the BDO Zone, and building up bale storage yards across the BDO Zone. Considering the above factors, the risk level was set to medium.

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**

3.7.2 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: No long-term weather trends or concerns were reported in this region to threaten the long-term availability of wheat straw and the supply chains. No major average air temperature fluctuations were apparent (see Figure C-8). Thus, risk for this indicator was deemed low.

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: No wildfires affecting wheat crops were reported.

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: No infestation risks that have significantly impacted the wheat production were reported in the region. Farmers are also covered by crop insurance. A low risk was assigned for this indicator.

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)*	**NN**

No adjustment. 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**

3.7.5 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: Extreme hail events have been reported during outreach but tend to be localized. However, the BDO Zone is large enough to provide significant buffer for these extreme events. However, risk is deemed moderate to account for these sudden drops in supply due to hail.

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**

3.7.6 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: No risk of flood was reported.

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	**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 4 out of 100.	**Score** **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: Historical wheat yield data (Figure A-1) in the Northeast Region of Alberta indicated two significant drops in 2015 and 2021, due to drought. The 2021 wheat crop was a 10-year low due to extreme drought. These large yield fluctuations indicate a high risk of weather events, such as droughts, to reduce the wheat straw supply. However, this risk can be mitigated by increasing participation rates, buffer storage, and reaching out to farms outside the BDO Zone. However, a medium risk level was assigned.

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**

3.7.8 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: No extreme wind events were reported. Maximum daily wind speeds in Forestburg AB (at 10 m altitude) varied between 22 km/h and 48 km/h in the past three years.[30] Thus, a very low risk of extreme wind events was assigned.

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**

3.7.9 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 daily lowest temperature in Forestburg AB has ranged between -35C and -40C with the exception of January 12-14, 2024 when the minimum temperatures varied between -42C and -47C.[31] No crop failures as a result of these low temperatures were reported as crops are planted in mid-late spring and harvested in the fall. However, the risk was slightly elevated to low-medium to account for sudden temperature variations that may affect wheat straw supply logistics/transportation.

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**

[30] https://www.alberta.ca/about-fuel-tax
[31] Ibid.

RRI Mitigation (Notch) No adjustment. 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 24 out of 100.	**Score** **24**

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: No government subsidies for the production and utilization of wheat straw were reported or found. Risk was therefore set at the very low level.

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**

3.8.2 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: Local and provincial agricultural experts recommend and encourage no till practices and no straw removals in order to enhance soil nutrition, humidity, and stability. Outreach indicated that wheat producers, especially those located in high straw producing areas with black soil types, are capable and willing to supply wheat straw while

concurrently maintaining and/or enhancing soil health through sustainable crop rotation and straw removal practices. Due to soil productivity variations that can influence participation rates, the risk was set to low-medium.

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**

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: Experience supplying larger quantities of wheat straw exists in Flagstaff County. In the early 2000s a strawboard plant operated in Forestburg for 6 months. The investment in the plant and equipment was financed in collaboration with local shareholders, many of whom were crop producers. The plant closed down due to alleged management and technical challenges. Unfortunately, this failed project left a lingering memory in the community for many years. However, outreach indicated that the unpleasant memory has almost completely faded. Moreover, the local producers, largely belonging to a generation that was not involved directly in the failed straw project, communicated the willingness to participate in a straw project under profitable and sustainable conditions. No backlash against a new wheat straw project in Roseburg is expected, thus, the risk was set to low.

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**

3.8.4 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: No issues were reported. An Indigenous Treaty Accord (Treaty 7) exists in the region.[32] No Indigenous land claims exist in Forestburg or the BDO Zone.

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 is a byproduct of wheat production. While wheat straw is sometimes mixed in cattle feed, these occurrences are rare and involve small quantities already discounted from the total available wheat straw production. Moreover, better feed choices exist, such barley and oats straw. Thus, the risk was set to very low.

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**

[32] www.rcaanc-cirnac.gc.ca/eng/1100100028793/1581292336658

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**

3.9 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: The rated wheat straw quantity was compiled by applying a 40% sustainable straw removal factor. The sustainable straw removal factor is an average straw removal that ensures that, on average, the annual removal of wheat straw from the BDO Zone does not affect negatively the soil health in the long term. This value was obtained through literature review and outreach to producers and implies a low risk of supply disturbance as a result of unsustainable harvesting practices. A low risk was assigned based on these considerations.

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**

3.9.2 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: Overharvesting or mining wheat straw can indeed negatively affect soil quality. By applying a 40% sustainable rate removal (see RI 3.9.1) and assuming higher participation rates of farms located in higher productivity

areas (i.e., black soil types), this risk can be minimized and/or controlled. However, it will be the responsibility of both producers and project developers to develop and implement sustainable straw removal practices that match soil quality and nutrient composition of every participating farm. Consequently, a low to medium risk level was assigned to this indicator.

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**

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: No issues were reported.

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**

3.9.4 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: Wheat straw removal equipment can contribute to soil compaction and reduced permeability. Also, straw removal may lead to soil moisture loss, especially during droughts. However, these situations can be mitigated through sustainable harvest removals and adapting harvesting schedules to soil conditions to reduce compaction. A low to medium risk was deemed appropriate for this indicator.

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**

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: No pesticides are used during wheat straw production and storage, especially as a portion of them are used for livestock and the remainder is currently used for soil nutrition and protection.

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**

3.9.6 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: Wheat straw removal and baling is an annual operation in the BDO Zone. No wildlife and landscape concerns have been raised. The sustainable removal of wheat straw and the subsequent logistics operations do not have an impact on the wildlife and landscape. According to the Canadian Wheat Grower's Association,[33] farmers employ sustainability practices and concerns every day as their farmland have been their livelihood for generations. These considerations triggered a very low risk score for this indicator.

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**

3.9.7 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)	**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**

[33] wheatgrowers.ca/public-policy/

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: Wheat straw quality is affected at every step in the harvesting, baling, transportation, and storing. A new entrant most likely would target the following quality attributes: moisture content, soil contamination, and bale size/bulk density. Since the current practice of supplying round bales for cattle bedding does not require strict quality standards, it will be necessary that the project proponent implement a quality control (QC) program for producers. Assuming such a QC program was implemented, the likelihood risk of supplying low quality wheat straw bales is deemed low, but the impact risk is deemed medium.

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**

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: If a new project located in Flagstaff County, AB was able to utilize the rated quantity of wheat straw, approximately 175 balers, 350 tractors, and 30 trucks with 53 ft flatbed trailers would be necessary to supply this amount. While the above requirements seem achievable under current equipment and labour availability, a large-scale wheat straw project would most likely require improved levels of baling and transportation efficiency. Consequently, investments in high-density square baling equipment will be necessary to double or even triple the baling and transportation efficiency. Producers communicated their willingness to invest in large square balers if a feasible, long-term agreement was drafted with the project proponents. The above considerations resulted in a medium risk level for this indicator.

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

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Industrial District

Risk Information: The proposed site is a 117-acre greenfield parcel (Map C-1 and C-2 in Appendix C) in the proposed Village of Forestburg/Flagstaff County Industrial Park for which an Area Structure Plan (ASP) has been completed. The parcel is zoned Highway Commercial (HC District). The proposed ASP development will provide a mix of commercial and industrial land uses that are compatible with one another and that will serve the surrounding residents, as well as, the surrounding communities. The site will allow for, but will not be limited to, the development of manufacturing, processing, repairing, fabrication, lumber yards, agricultural support services and sales, agro-industrial, agritourism, automotive and equipment maintenance and repair, bulk fuel storage and sales, contractor services, general retail, indoor storage, veterinary clinics, railway operations, retail and service businesses, and automobile, truck and farm equipment sales. Overall, the proposed site can support a large-scale biomass project and its inbound and outbound logistics; thus, a low risk was assigned.

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**

5.1.2 Ownership of Land

Risk Information: According to the Forestburg/Flagstaff Industrial Area Structure Plan (2023), ownership comprises both municipal and privately owned lands (Maps C-1 and C-2). The NW quarter section currently has multiple developed lots on the western half of the lands that are subdivided and registered at Alberta Land Titles. The eastern portion of the NW quarter section consists of farmland. The NE quarter section is generally cleared and used for agricultural crop production. Battle River Rail (BRR) owns a rail line that forms part of the eastern boundary of the ASP. Plots of land in the industrial area can either be purchased or leased. No land ownership constraints exist against a wheat straw project; therefore, the risk was deemed low.

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: The Flagstaff County Planning and Development Officer has advised that currently there is a 40-day range for approval of a development permit, building permit, etc. Thus, the risk was set to low for this indicator.

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**

5.1.4 Environmental Issues

Risk Information: The Area Structure Plan (ASP) includes: an environmental site assessment, a geotechnical investigation, a traffic impact assessment, a historical resources overview, and a biophysical assessment. The environmental site assessment concluded that the potential for environmental impact to the site was generally considered low. The biophysical assessment confirmed ten wetlands, ranging in size between 0.04 ha and 1.60 ha within the ASP area. None of the wetlands supported any surface water at the time of the site visit, however, historical aerial photographs suggest that, at times, open water may have been present, although relatively shallow. A Wetland Assessment Impact Report will be submitted to Alberta Environment for approval with all compensation for the loss of wetlands to be paid to Alberta Environment prior to subdivision and development of these areas. The zoning designation regulate that all industrial activities within the ASP area will not result in the emission of odours, dust, smoke, gas, noise or vibration, and will not damage or interfere with adjacent land uses. Open storage may be located outdoors provided it is screened from view of public roadways or public spaces. The environmental impact of a new wheat straw facility will depend on the transformation/manufacturing technology employed and could vary between low to high. Thus, an average medium risk level was assigned.

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 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: Natural gas is available to the proposed site (Map C-6) and can meet any natural gas requirements. Atco is the provider of natural gas in the area and the current business rate for 1 year contract is $3.69/GJ + $8.99 per service per month. There are other contract options available.[34] Bulk discounts for large business users can be negotiated. Natural gas availability at the site resulted in a low risk level.

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**

[34] store.atco.com/ccrz__HomePage?offerType=business&store=DefaultStore&cclcl=en_US

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**

5.2.2 Electric Availability

Risk Information: Atco is also the provider of electricity in the region at business plan rates of 11.59 c/kWh + $8.99 per service per month. There are other contract options available including bundles of natural gas and electricity plans.[35] Three phase electricity currently exists at the proposed property line and it is assumed to be extended into the industrial site at the time of development. A low risk level was deemed appropriate for this indicator due to power availability at the site.

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

5.2.3 Water Availability

Risk Information: There are two options available for the project proponent: to install a well and septic system, or to tap into the Village of Forestburg utilities (Maps C-4 and C-5). The new Forestburg water treatment plant can supply commercial, industrial, and residential needs. The plant was designed to supply a population twice the size of present population.[36] The current utility rate bylaw[37] specifies the following rates: water at $2.58 per m^3 + $24.70/month infrastructure maintenance fee and sewer at $0.72 per m^3 of water and $9/month infrastructure maintenance fee. The risk was set to low to reflect the availability of water at the industrial site.

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

[35] store.atco.com/ccrz__HomePage?offerType=business&store=DefaultStore&cclcl=en_US
[36] https://www.forestburg.ca/economic-development
[37] forestburg.civicweb.net/document/9874/

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**

5.2.4 Waste Disposal

Risk Information: The Village of Forestburg provides garbage collection. The current utility rate bylaw[38] specifies the rate of $30.35 per month for developed properties. The Flagstaff Waste[39] caters to commercial customers at different disposal rates depending of the materials being collected.[40] Bin rentals of various sizes are also available.[41] Waste disposal options are appropriate at the proposed location; thus, the risk was set to low.

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**

5.2.5 Internet Availability

Risk Information: Fiberoptic high-speed internet is available and provided by Eastlink[42] and Xplore.[43] High-speed internet is a very important part of today's business environment. Availability of high-speed internet at the proposed location was set to very low to reflect that importance.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**2**

[38] forestburg.civicweb.net/document/9874/
[39] flagwaste.ca/
[40] flagwaste.ca/commercialindustrial-landfill-fee-schedule/
[41] flagwaste.ca/bin-rental/
[42] www.eastlink.ca/internet
[43] www.xplore.ca/

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**

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: The site is located south of Highway 53, east of 53 Street and west of the Battle River Railway and Range Road 151 (Map C-3). The site is within easy driving distance from major centres such as Camrose, Edmonton, Red Deer, and other important destinations as follows:

- 82 kilometres east of Camrose.
- 145 kilometres west of Wainwright.
- 180 kilometres southeast of Edmonton.
- 145 kilometres northeast of Red Deer.
- 298 kilometres northeast of Calgary.
- 160 kilometres from Saskatchewan border.
- 440 kilometres north of United States border.

An Area Concept Plan (ACP) included a general transportation concept (Map C-3) that provides a functional and effective transportation system. A Transportation Impact Assessment has been completed. The traffic pattern within the area provides for safe and efficient movement of traffic and includes the addition of a rail spur line. The existing and planned road network is appropriate for a new project; consequently, the risk was set to low.

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

5.3.2 Rail Access

Risk Information: The Battle River Railway (BRR) with the head office in Forestburg has a track that runs adjacent to the eastern boundary of the site and runs in a northwest to southeast direction. The BRR line is a full-service railway that runs from Alliance in the east to the main CN line in Camrose. Discussion with the Village of Forestburg and Flagstaff County has indicated interest in utilizing this track to attract development within the industrial park. A central right-of-way and transload area were set aside to allow for future development of a train loading and offloading area (Map C-3). Rail access is an important condition for a successful business; thus, the risk was set to low.

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**

5.3.3 Airport Access

Risk Information: The site has access to the Flagstaff Regional Airport and Hardisty Airport, located 45 km and 55 km, respectively, from Forestburg. The Edmonton International Airport is located 150 kilometres away. Due to appropriate access to both regional and international airports the risk score was set to low.

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**

5.3.4 Water Freight Access

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

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: Forestburg is located less than half an hour from hospitals in Daysland and Killam. Forestburg also has twenty-four-hour ambulance service. There is also a medical clinic open several days a week and a one-day a week dental office. Forestburg also has services of a chiropractor, massage therapist, and a full-service pharmacy. Healthcare is appropriate for a rural community and a new project will benefit from it; thus, the risk level was set to low.	
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**

5.4.2 Education (Schools)

Risk Information: Forestburg is home to the Forestburg School, a K-12 school with an in-house Kindergarten and playschool. The Forestburg School is of the few Alberta rural schools with a full junior high, and high school band program. Forestburg School is also home to an extremely generous scholarship and bursary program. Since 1996, over half of Forestburg School students have enjoyed international travel to Germany, France, China, and Japan. Forestburg is less than one hour away from Augustana University Campus in Camrose, and two hours away from the University of Alberta main campus in Edmonton. Educational upgrading, ESL, and adult education training are available in Killam. The Northern Alberta Institute of Technology is located two hours away in Edmonton. Other educational facilities such as

Lakeland College in Vermillion, and Olds College in Olds are each approximately two hours away. A low risk was assigned due to the wealth of educational opportunities offered by the proposed location.
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**

5.4.3 Local Transportation

Risk Information: Not relevant as Forestburg is a rural community located at walking distance from the proposed project location.
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**

5.4.4 Public Safety (Local)

Risk Information: Forestburg is a safe village served by the Killam RCMP located twenty-five minutes away. It also shares the services of a Peace Officer with Flagstaff County, and a contracted bylaw enforcement officer. The Forestburg Volunteer Fire Department is a fully equipped, highly trained group of dedicated men and women serving Forestburg and surrounding area. Risk was thus set to low.
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 The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

5.4.5 Housing/Cost of Living

Risk Information: Forestburg has a very flexible supply of residential, commercial, and industrial property.[44] Several of the properties are already or can be readily serviced from Forestburg with water, gas, sewer, and electricity. Forestburg has several residential properties for sale, and has recently commissioned thirteen lots in the first phase of a new subdivision. A Realtor.ca search produced 13 listings of lots for sale in a subdivision, ranging in price between $40,600 and $67,600 and 9 listings of single-family houses ranging in price from $69,000 to $430,000. The vast majority of residents own their homes. One rental property was found during the search at a monthly rental of $875. Risk was set to low likelihood-medium impact as no information currently exists regarding the housing requirements of the new 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 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)* 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**

5.5 Risk Factor: Labour

5.5.1 Workforce

Risk Information: Forestburg can provide a workforce with an abundance of trades and professional skills including IT and computer skills.[45] It is an agriculturally-based community with a wide range of services such as seed, chemical, research, bulk fuel, and producer car shipping. Residents are proud of their extensive range of agricultural expertise within the Village and immediate vicinity. Through many decades of power and coal generation they have a wide variety of journeymen, office staff, and administrators. They are fortunate to have retained many of the next generation of farmers in this area and thus another layer of expertise needed if a wheat straw project was developed here. Forestburg is also able to draw workers from the surrounding communities of Heisler, Galahad, and Alliance. Forestburg also has a

[44] www.forestburg.ca/economic-development
[45] Ibid.

well-established industrial, commercial, and employment base. Some of the larger business and employers include: Forestburg Transit Mix Ltd., McNabb Construction, PRISM Integrated Solutions, Forestburg Seed Cleaning Plant, Battle River Railway, Battle River Ironworks, and Forster's Greenhouse. Large scale industries also exist in the region, such as the oil and gas large-scale operation in the vicinity of the Village of Hardisty.

Flagstaff County is located in the Camrose-Drumheller region which had in 2024 an average unemployment rate of 4.6%, compared to the current Alberta average rate of 6.3%.[46] Unemployment rates in the region decreased since 2020 and have stabilized to pre-pandemic rates (Figure C-9).[47] People in Forestburg working in trades and transportation account for the largest share of the local workforce (90 individuals), followed by those in sales and service (80 individuals) and natural resources and agriculture (45 individuals). Approximately 34.1% of the population in Forestburg has a high school diploma (215 residents). Forestburg locals holding a college diploma (125 people) account for 19.8% of the resident pool. Additionally, 8.7% of them hold a university degree (55 people).[48]

Outreach confirmed that both employment seekers and job opportunities exist in the Forestburg area. Closeness to vocational colleges and universities can appropriately address any training requirements for a new project. Also, the strawboard project in the early 2000s employed 15 local residents. Consequently, a similar employment requirement for a new project would seem achievable with local workforce. However, due to uncertainties regarding the size of the new project and labour situation at the time of project deployment, this indicator was assigned a low-medium risk level.

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**

5.5.2 Labour Costs

Risk Information: According to Point2Homes site,[49] the median household income in Forestburg is $79,000 compared to provincial average of $80,500,[50] while the median after-tax household income sits at $70,500 per year compared to provincial average in 2020 of $83,000.[51] Outreach indicated that the hourly rate paid for agricultural skilled workers is around $30. The former Forestburg strawboard plant used to employ 15 local people, not including the straw suppliers

[46] economicdashboard.alberta.ca/dashboard/unemployment-rate/#section7
[47] Ibid.
[48] www.point2homes.com/CA/Demographics/AB/Forestburg-Demographics.html
[49] Ibid.
[50] www.insurdinary.ca/average-household-income-in-canada/
[51] www150.statcan.gc.ca/n1/daily-quotidien/220713/mc-d001-eng.htm

(unknown). A new project proponent would have to match the current skilled labour costs presented above. As in the previous indicator, the risk was slightly elevated to low-medium to account for potential uncertainties related to the size of the new 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 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)* 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**

APPENDIX C: TABLES AND FIGURES

Figure C-1. Wheat Straw Transportation Cost by Distance from Forestburg, AB[52]

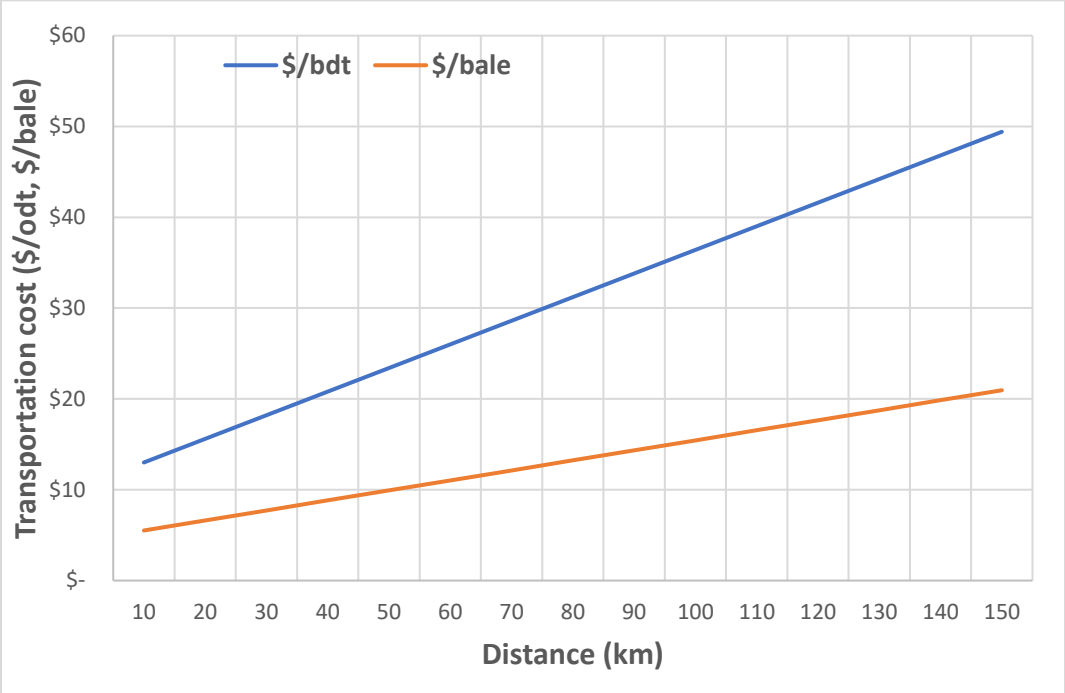
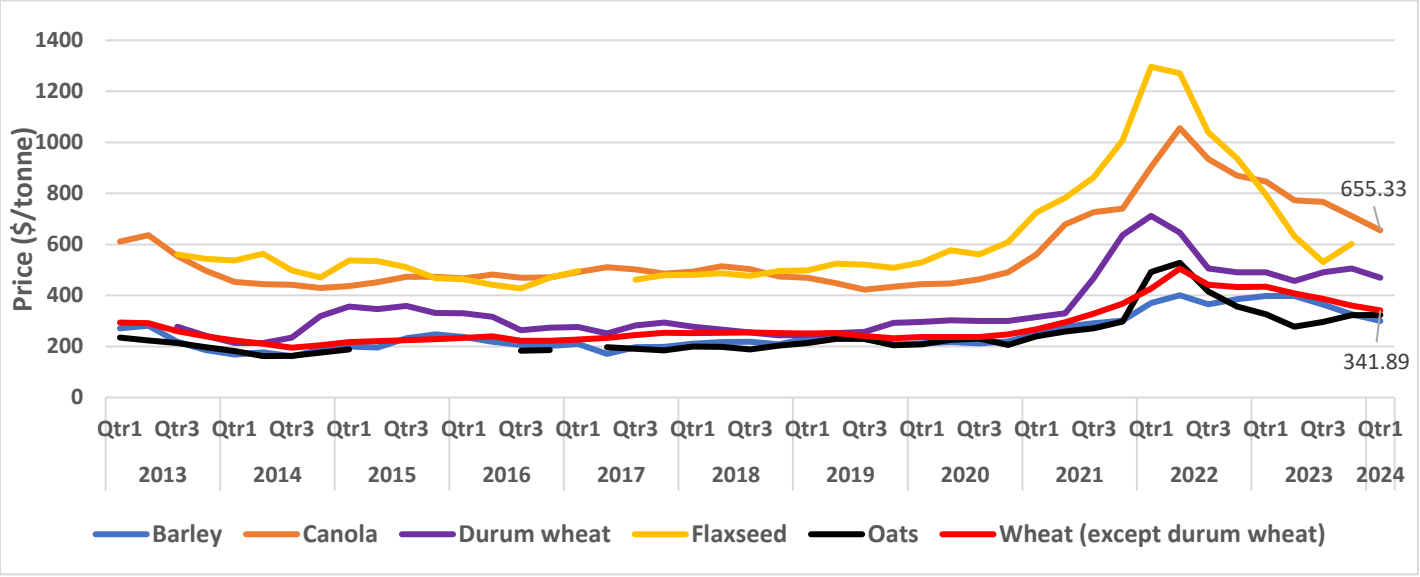


Figure C-2. Historical Grain Prices in Alberta (2013-2024)[53]



[52] Assumptions: 34-1,100 lbs round bales on a 53 ft flatbed trailer, $150/hr (personal communications with local transportation provider), 1 hr loading/unloading time, 80 km/hr average speed;
[53] www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210007701

Figure C-3. Historical Wheat Straw Prices ($/bale)[54]

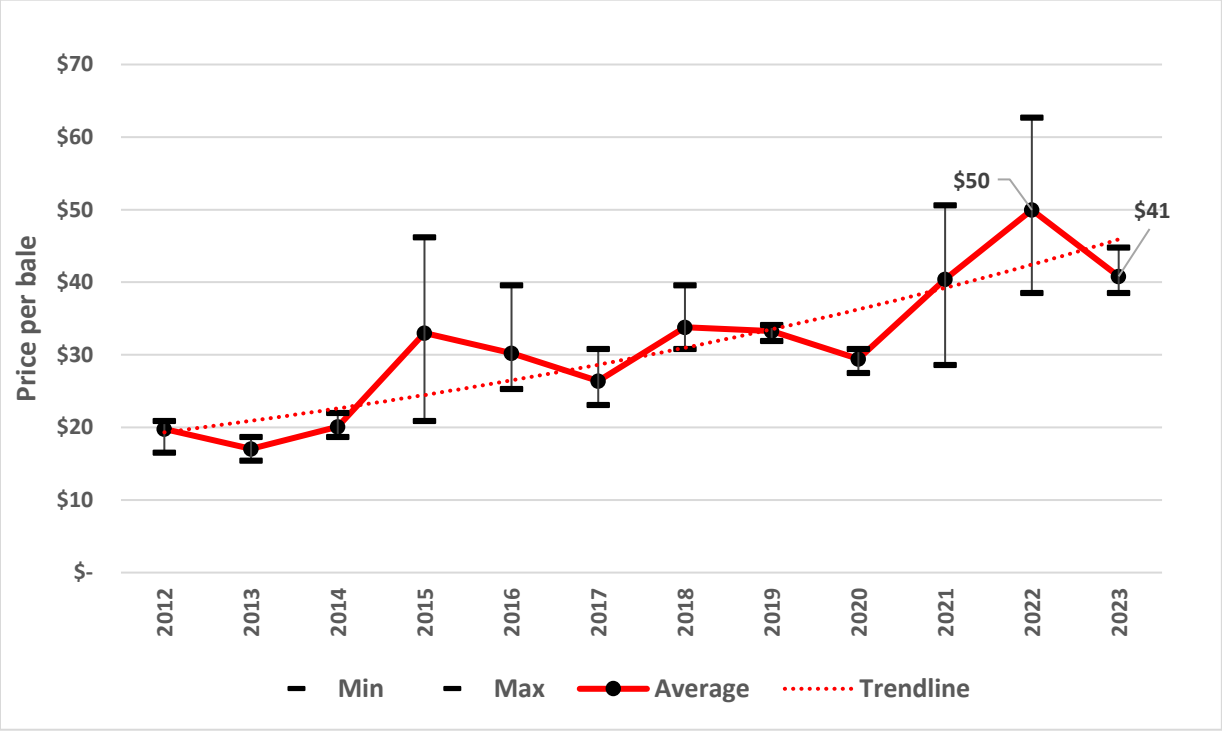
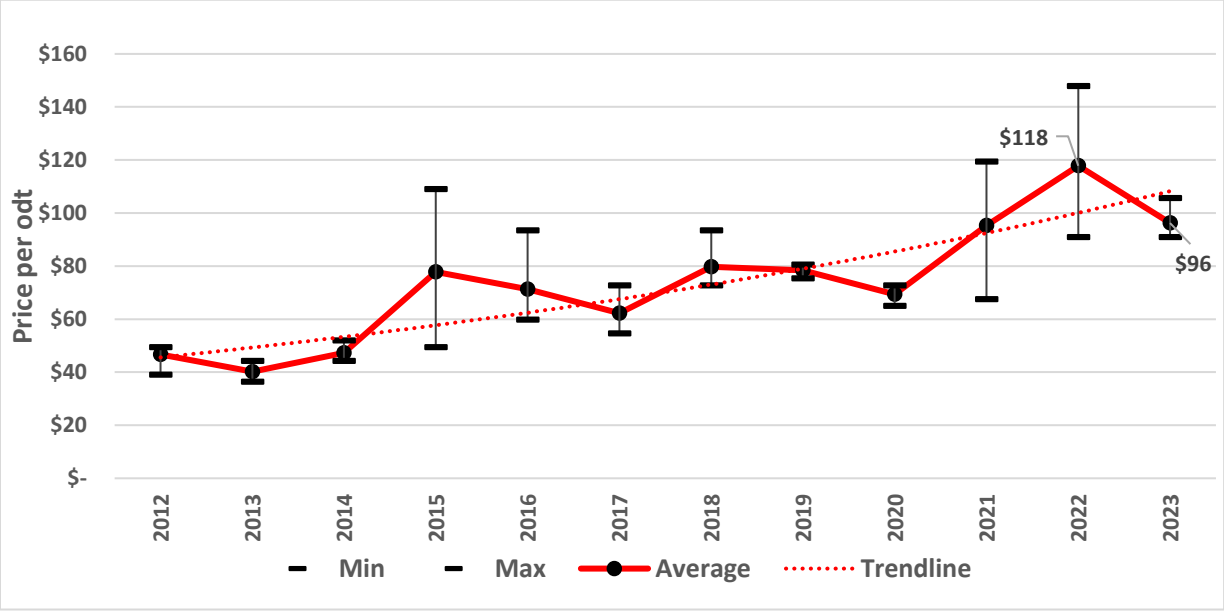


Figure C-4. Historical Wheat Straw Prices ($/odt)[55]



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

Figure C-5. Historical Prices of diesel in Edmonton/Calgary AB[56]

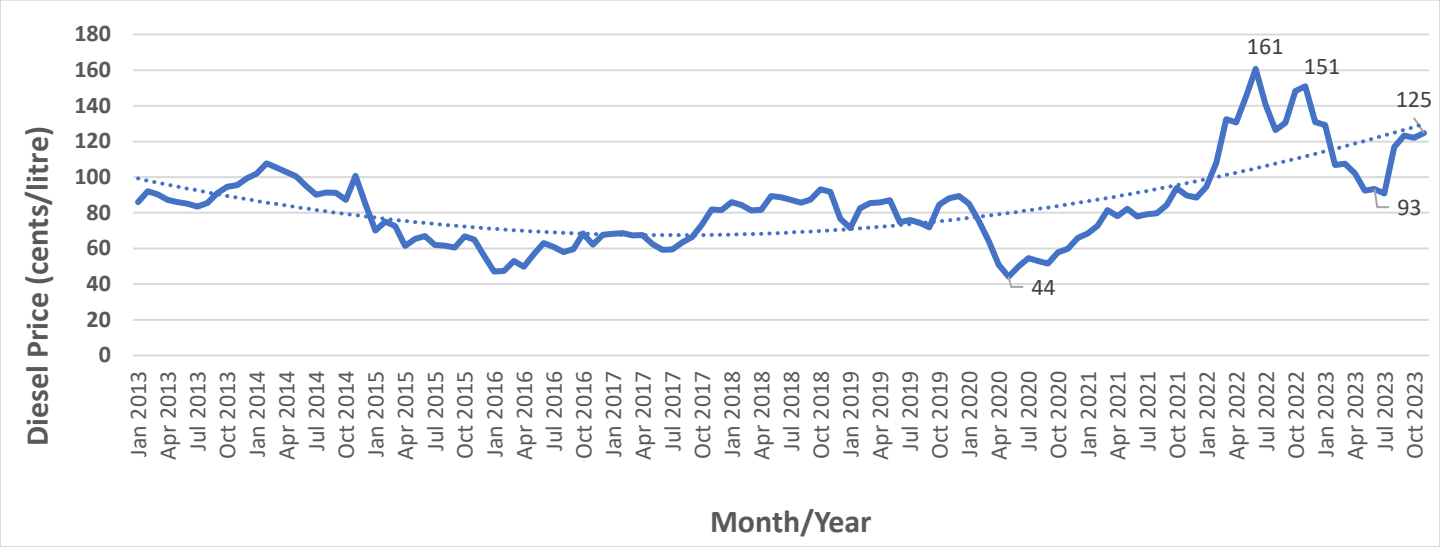
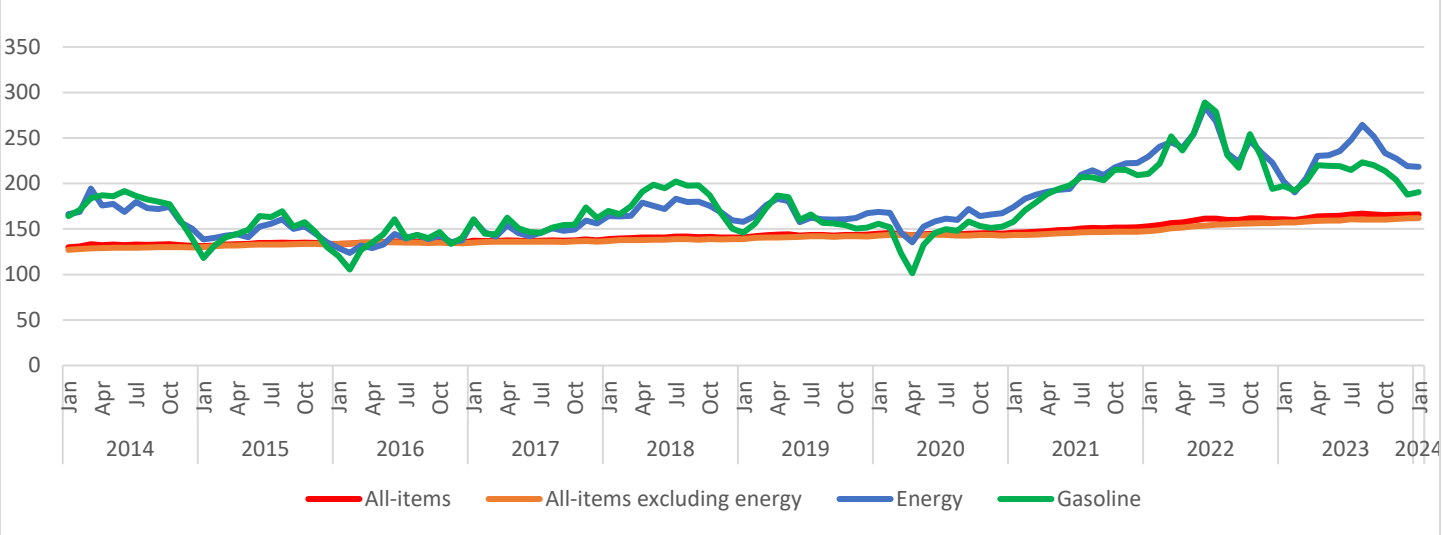


Figure C-6. Consumer Price Index - Alberta (2014-2024)[57]



[56] www.alberta.ca/system/files/tec-diesel-fuel-cost-adjustment-mar2006-nov2023.pdf
[57] www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000401

Figure C-7. Industrial Product Price Index - Prairie Provinces (2014-2024)[58]

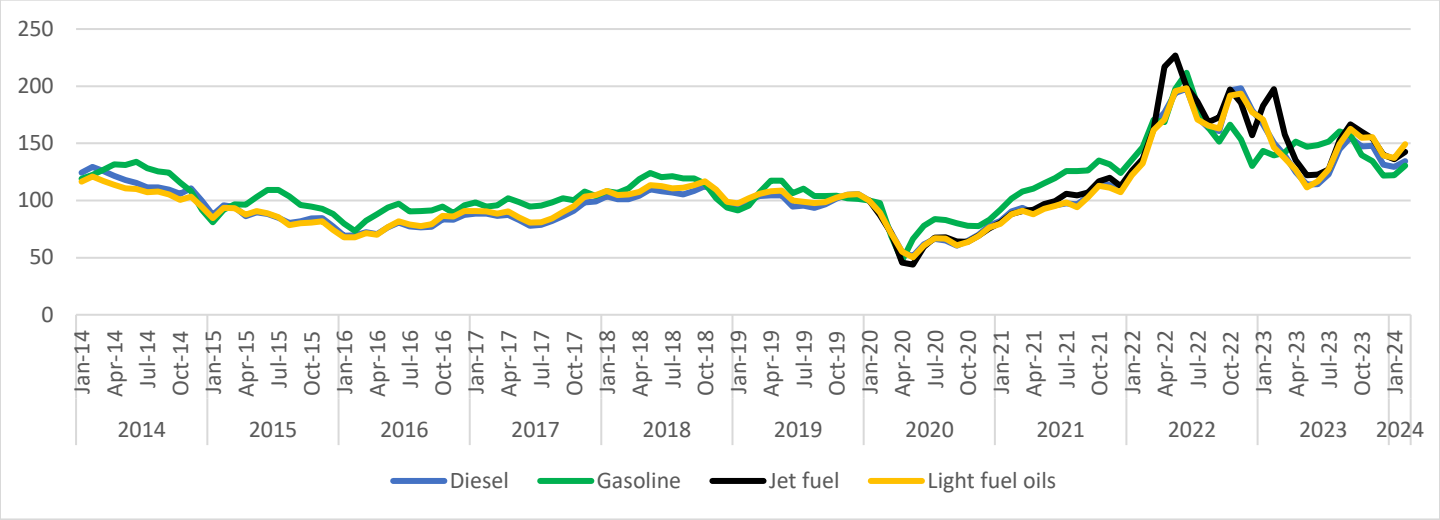
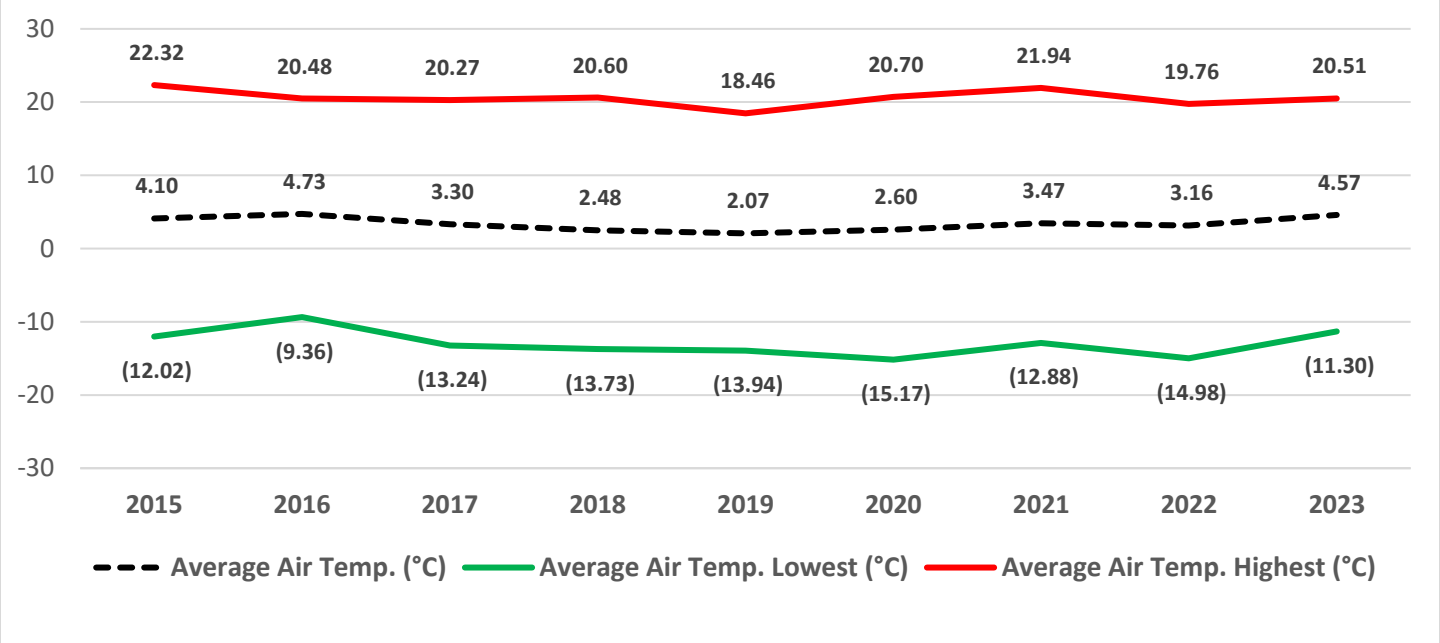
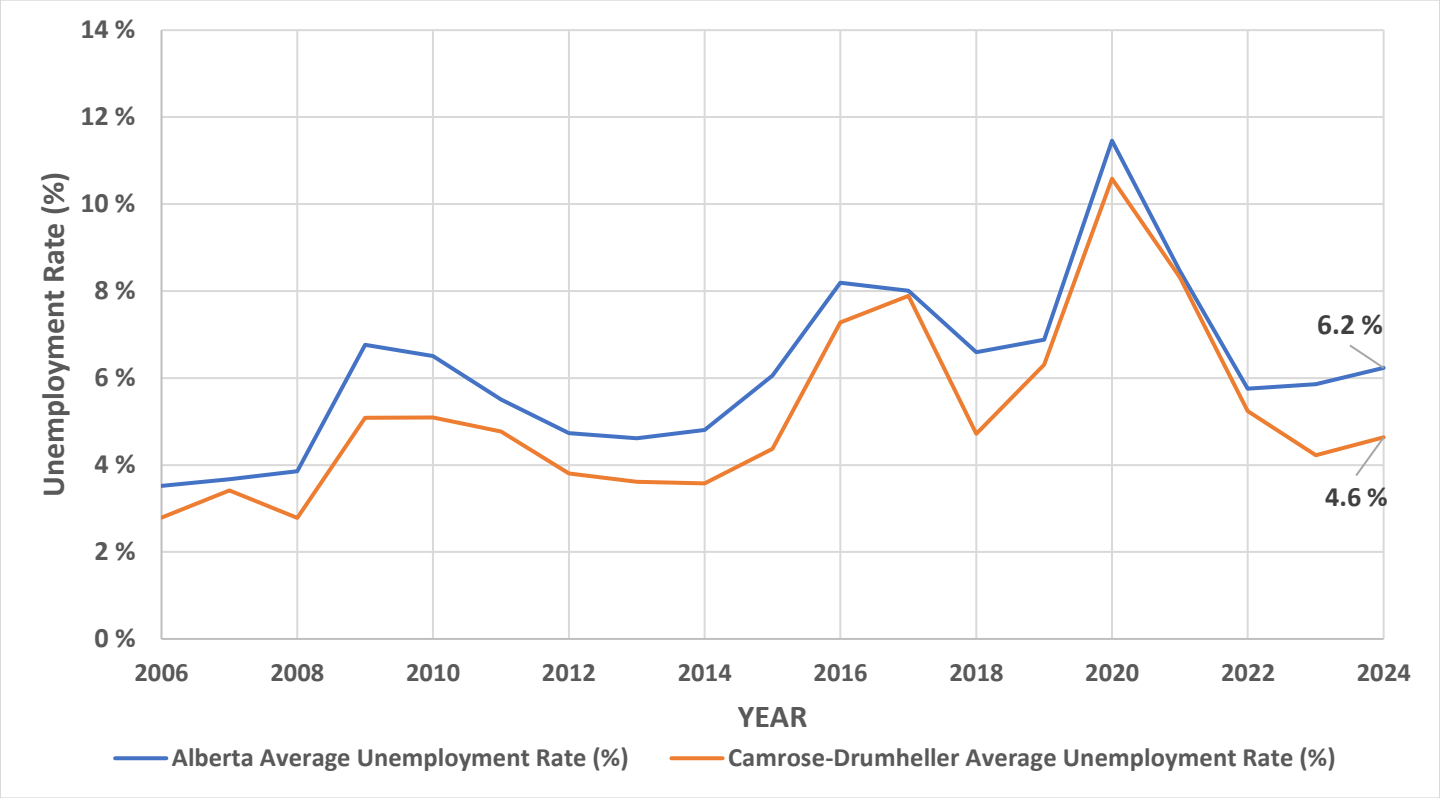


Figure C-8. Average Annual Air Temperatures in Forestburg AB (2015-2023)[59]



[58] www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810027201
[59] acis.alberta.ca/township-data-viewer.jsp

Figure C-9. Historical Unemployment Rates in Alberta and Camrose-Drumheller Region (2006-24)[60]



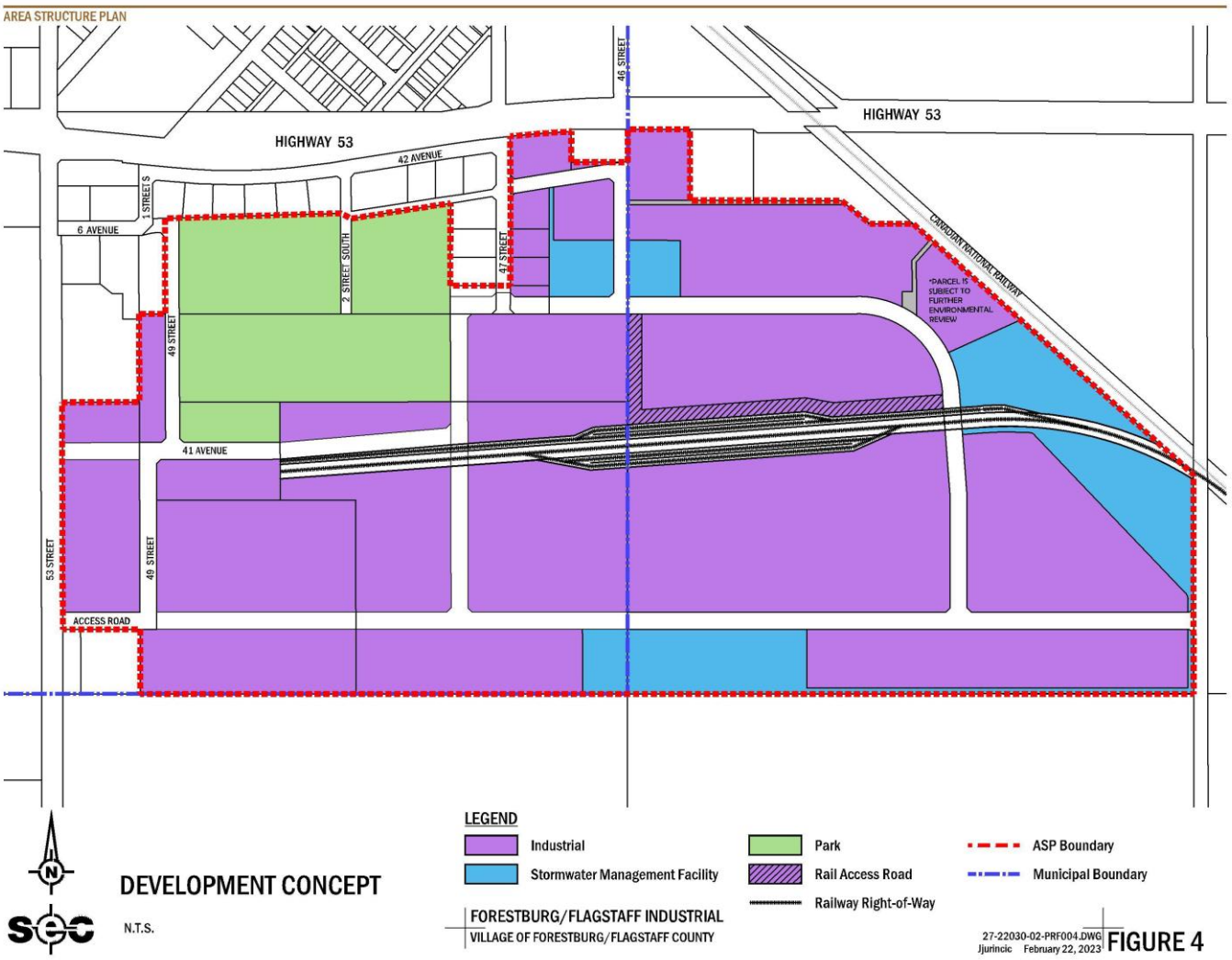
[60] economicdashboard.alberta.ca/dashboard/unemployment-rate/#section7

Map C-1. Map of Proposed Industrial Site[61]



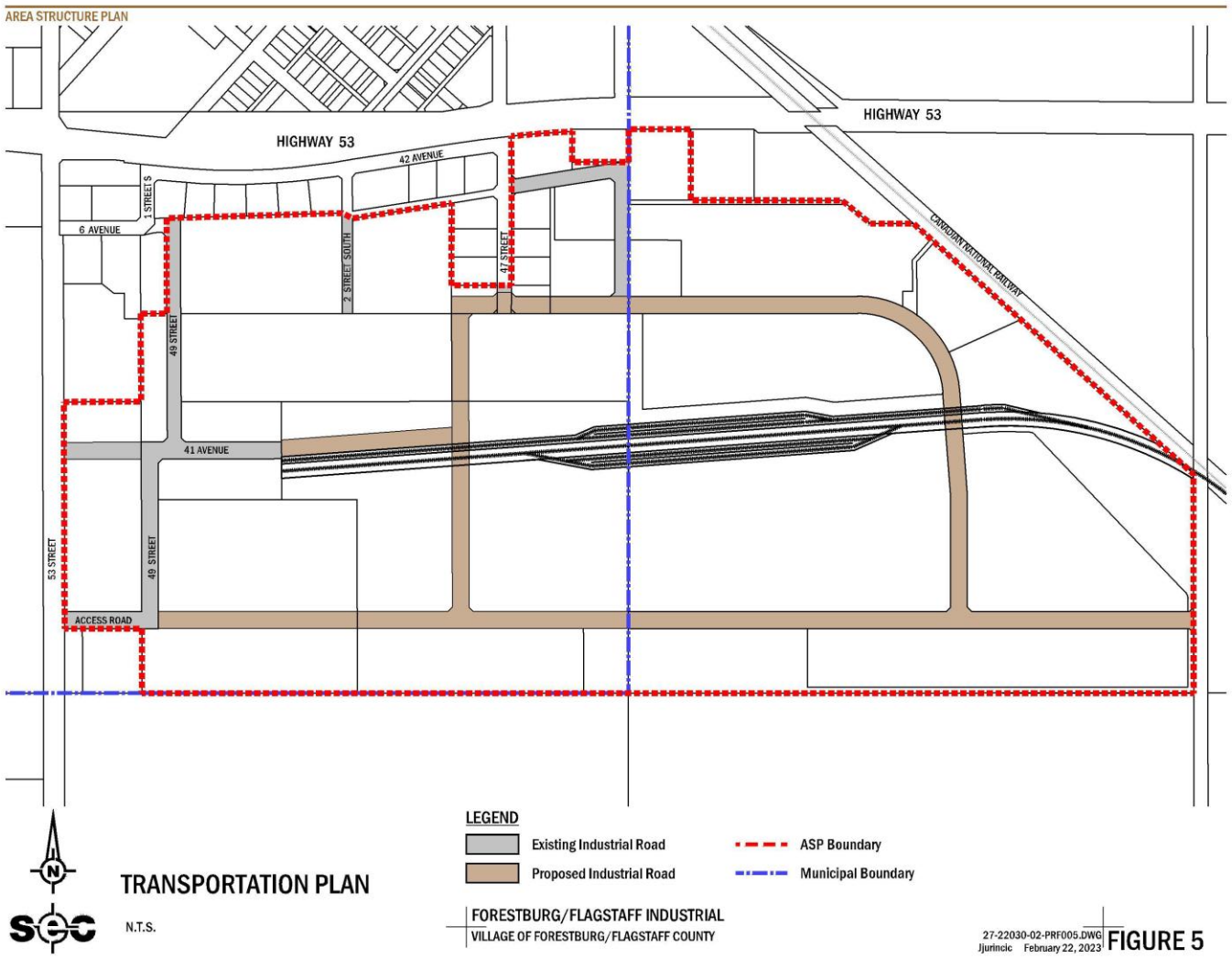
[61] Source: Flagstaff County Office

Map C-2. Map of Development Concept[62]



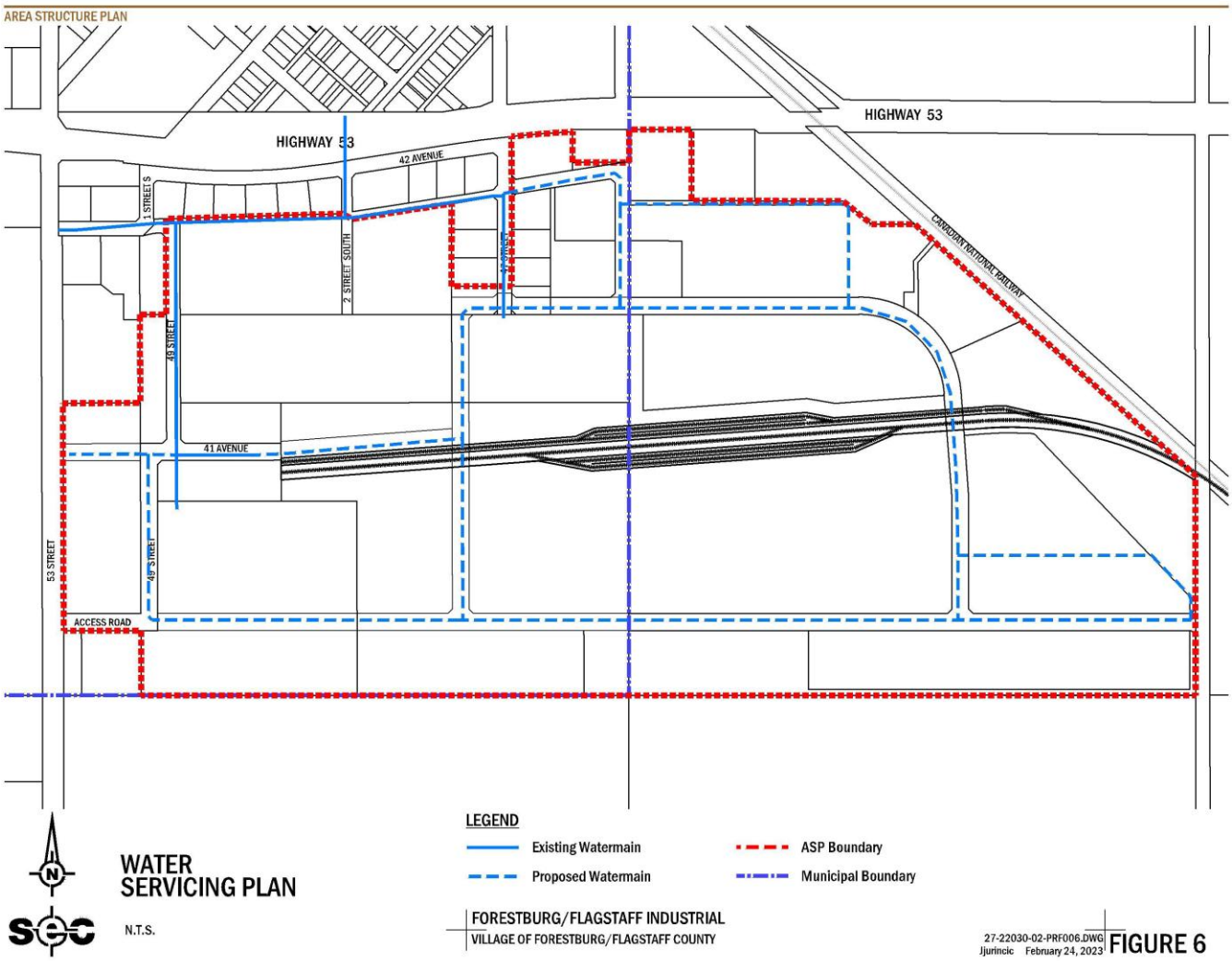
[62] Ibid.

Map C-3. Map of Transportation Plan[63]



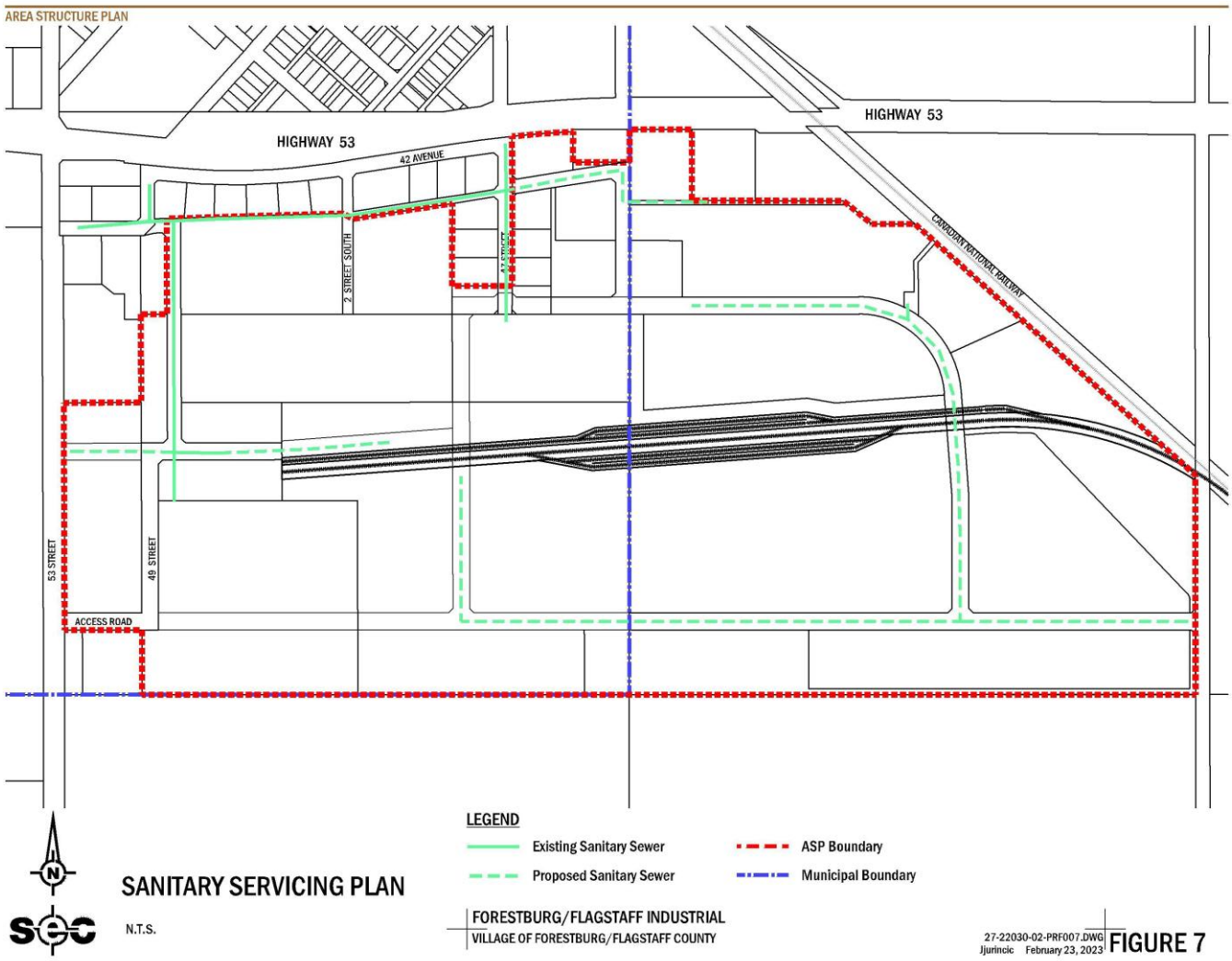
[63] Ibid.

Map C-4. Map of Water Servicing Plan[64]



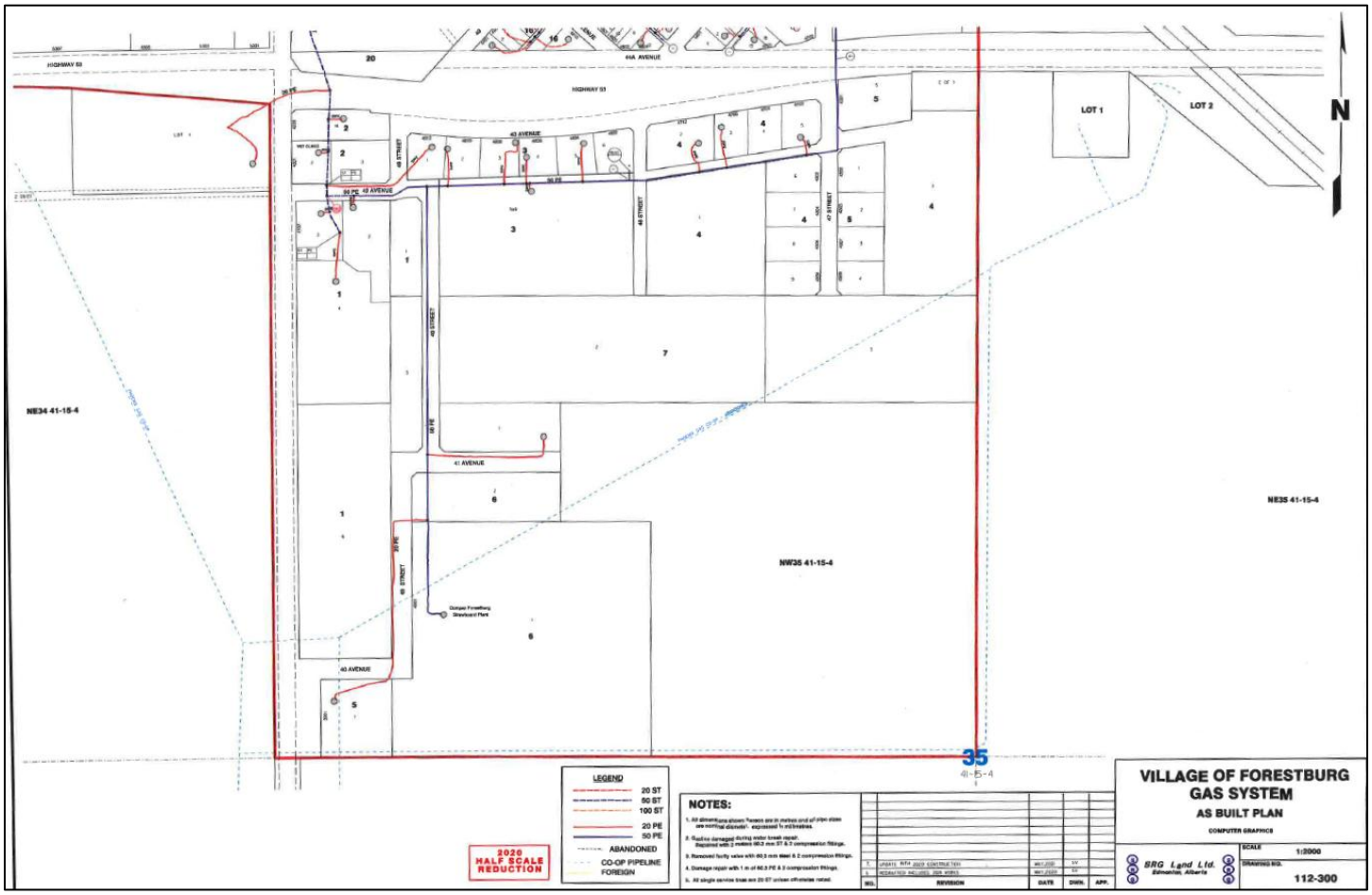
[64] Ibid.

Map C-5. Map of Sanitary Servicing Plan[65]



[65] Ibid.

Map C-6. Map of Natural Gas System[66]



[66] Ibid.

APPENDIX D: LEGAL DISCLAIMER

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