**Biofuel Development Opportunity Zone Risk Rating**

# 'A'

The Southwest Nova Scotia Biofuel Development Opportunity Zone is rated 'A.' A substantial quantity of biomass remains available at low risk under the province's new ecological forestry regulations.

**Rating Parameters:**

| Category | Rated Quantity | Delivered Cost | BDO Zone Size |
|---|---|---|---|
| Pulpwood | 400,000 GMT/yr | $55-$70 (GMT) | 150-km maximum |
| Sawmill Residuals | 150,000 GMT/yr | $25-$60 (GMT) | road distance from |
| Forest Residues | N/A | N/A | Caledonia, NS |

## BDO Zone Assets

- **550,000 GMT/yr of woody biomass potentially available for new projects**
- **A large sawmill that has recently expanded woodland and milling operations**
- **A mechanized contractor base with experience producing the rated quantity of roundwood**
- **Ecological forestry regulations ensure sustainable wood supply from public lands**
- **Four sites suitable for bio-project development within 150 km of the Port of Halifax**

## BDO Zone Liabilities

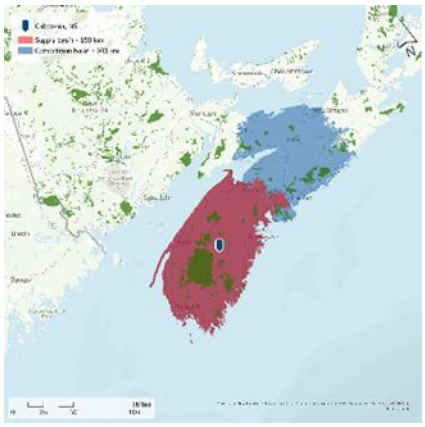
- **Significant trucking capacity shortages**
- **Road weight restrictions and diesel price trends introduce transport cost risk**
- **Increased partial harvesting and protected area coverage increase wood supply costs**

## BDO Zone Risk Rating

**The Southwest Nova Scotia, 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*), and BBB (*low-moderate*), BB (*moderate*), B (*moderate-high*), C (*high*).

### Southwest Nova Scotia BDO Zone



### Scoring & Rating Methodology

In assessing the biomass supply chain risk for the Biofuel Development Opportunity (BDO) Zone, 48 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 green metric tonnes per year (GMT/yr). Feedstock costs are expressed in Canadian dollars (CAD). Maximum transport distance is based on a 150-km maximum driving distance from the center point (Caledonia, NS).

Next, each Risk Indicator is discounted, or "notched," based on the degree to which the uncertainty drivers are deemed addressable and whether there are reasonable expectations that mitigation measures could be put into place within the price parameters for this rating.

The **Notched Salience score** corresponds to the likelihood of each Risk Indicator's described risk materializing given the implementation of economically reasonable mitigation measures. To arrive at the Notched Salience score, Raw RI scores are reduced based on the effectiveness of the likely mitigation measures. If applicable, notching occurs at one of 3 levels: 25%, 50%, or 75%.

Finally, the potential impact of each Risk Indicator on the supply chain is assessed and scored on an **Impact Level** scale as either low (3.33), moderate (6.66), or high (9.99). Impact level scores are based on assumptions that key measures were implemented to mitigate uncertainty drivers in the BDO Zone but failed to do so.

The **Loaded RI** score for each Risk Indicator is calculated as the product of Notched Salience and Impact Level scores. For example, if the Risk Indicator 'Competitor Price and Price Sensitivity' is scored at a Raw Score of 4, a Notched Salience of 2, and the Impact Level is high (i.e., 9.99). The final Loaded RI score for this risk indicator is 2 × 9.99 = 19.98 (out of 100).

Loaded RI scores of 33.33 or less are deemed low risk; scores greater than 33.33 and less than 66.66 are deemed moderate risk; and those that score 66.66 to 100 are deemed high risk.

The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Southwest Nova Scotia is ***18.66 out of 100, resulting in an 'A' designation***.

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

## Analyst Notes

The Southwest Nova Scotia (SW NS) BDO Zone centers in the town of Caledonia, NS. The supply basin for the analysis (max. 150-km road distance from Caledonia) encompasses a ~21,000 square kilometer area that includes the seven counties comprising Western Nova Scotia as well as portions of Hants and Halifax counties. The competition zone encompasses a ~36,000 square kilometer area that extends beyond Sheet Harbour, New Glasgow, and into Cumberland County.

Most of the land base within the supply basin is part of the Western ecoregion. The ecoregion is characterized by a relatively mild climate, extensive rivers, lakes, and wetlands, and a mixed terrain of exposed bedrock, glacial hills (drumlins), and river valleys. Major commercial tree species utilized for lumber and solid wood product manufacturing include red spruce, white pine, and hemlock. There are currently no markets for low-grade softwood roundwood. Regional hardwood markets are restricted to two wood processing facilities and a number of small-scale firewood producers.

The total area of working forest in SW NS (approx. 1,000,000 ha) is comprised of smaller privately owned woodlots averaging 100 ha (50-60% of total working forest area) and larger tracts of private lands and public ("Crown") lands over which forestry planning and management activities occur at scale (40-50% of total working forest area). Wood supply in the region is disproportionately sourced from private lands; between 2013 and 2020, harvesting on private working forest accounted for ~75% of total wood supply (Appendix B). The majority of Crown lands in the region are under the management of WestFor Management Inc. (300,000 – 390,000 ha of working forest). First Nations- and community-owned lands amount to less than 5% of the publicly owned land base (~35,000 ha). Approximately 225,000 ha of forested land in SW NS is protected within Wilderness Areas, National Parks, Provincial Parks, and Nature Reserves.

One of the largest sawmills in the province is located within the supply basin. Freeman Lumber has an annual lumber production capacity of 110 million board feet (MMBF) and specializes in softwood lumber production. The mill procures >80% of the annual wood supply in Western NS. The eight other sawmills located within the supply basin have lumber production capacities <3.5 MMBF/yr and consume less than 50,000 GMT/yr. Total annual production of sawmill residuals (chips, sawdust, shavings, and bark) is estimated to be approx.

230,000 GMT/yr. Two medium capacity sawmills – one premium grade lumber (30 MMBF/yr) and the other specialized in processing smaller diameter roundwood (70 MMBF/yr) – are located just outside the supply basin.

In 2020, roundwood production in SW NS reached a 15-year low (833,000 $m^3$, or 750,000 GMT). Current growth-to-removal ratios likely exceed 1.2 for most commercial tree species. Demand for low-quality roundwood has been significantly reduced in SW NS since the closure of the Bowater Mersey paper mill in 2012. Demand for wood fiber produced in SW NS further declined in 2020 following the closure of the Northern Pulp kraft paper mill in Pictou County. A single paper mill remains in operation in Nova Scotia but is located >250 km away from the eastern edge of the supply basin and 400 km away from the center point at Caledonia. Potential suppliers of low-grade roundwood (pulpwood) and residuals in SW NS generally cannot sell at profit to the mill owing to excessive transportation costs.

Competitors for lower quality wood fiber in the supply basin (not including firewood) include a 28 MW biomass-based power plant, a wood siding manufacturing facility, and at least one small-scale heating facility. Within the wider competition zone (300 km maximum road distance from Caledonia), competitors include a 1 MW cogeneration facility, two pellet mills, a wood chip export terminal, and at least two small-scale heating facilities.

Competitors are generally restricted in their demands to sawmill residuals. Since 2020, most wood chips, sawdust, and bark produced within the region have been purchased by the 28 MW biopower plant to meet the province's renewable energy targets. Current prices for wood chips average $35/GMT FOB and prices for bark and sawdust range from $15-20/GMT FOB. In comparison, prices for wood chips produced within the more eastern areas of the supply basin averaged $50/GMT up until the closure of Northern Pulp in 2020. For areas further west, comparable prices were common in the early 2000s up until the closure of the Bowater Mersey paper mill in 2012.

Consistent demand for low-grade roundwood produced within the supply basin is restricted to the wood siding manufacturing facility, which intakes approx. 100,000 GMT/yr of hardwood pulpwood. The 28 MW biopower plant infrequently purchases smaller quantities of roundwood (~20,000 GMT); the most recent purchase of this kind was made in 2017/18. Excluding hardwoods suitable for use as firewood, total demand for low-grade roundwood in the supply basin likely does not exceed 125,000 GMT/yr. The lack of demand for low-grade roundwood has led to the retention of diameter classes and species that would normally be recovered under ideal market conditions. Current prices for low-grade roundwood range from $40/GMT to $65/GMT delivered.

Given current demand from the region's sawmills, we estimate that at least 200,000 GMT/yr of low-grade roundwood (~60% softwood, 40% hardwood) is left unutilized during conventional forest operations within the supply basin (Appendix B). This quantity is available for new projects without any increase in annual harvested area. A further 200,000 GMT/yr could be made available with increases in annual harvesting activity. Procuring this quantity of low-grade roundwood would require additional workers and equipment, and would consequently increase the annual production of sawlogs. Sawmill capacity in the supply basin is sufficient to process this increased supply of sawlogs, resulting in an increase in sawmill residuals production if demand for lumber is sufficient.

Forest residue (e.g., tops and branches of trees not recovered during conventional logging operations) was not considered in the analysis. Although there is some residue recovery experience in Nova Scotia, it is unlikely to

succeed for operational and regulatory reasons. At least 550,000 GMT/yr of low grade roundwood and sawmill residuals are available for new projects at low risk, without the need for forest residue recovery.

### Key Risk Indicators

The SW NS BDO Zone has significant economic and institutional strengths of relevance to the development of new bio-projects. The forest industry in the region is well developed, with established milling and logging infrastructure, an experienced workforce, and public support for, and tolerance of, forestry and trucking operations. Over a dozen governmental and non-profit organizations are actively collaborating with industry to develop the forest sector. Workforce recruitment and training programs are also in an advanced stage of development compared to other regions in North America. Prospective investors in new biomass-based projects are further advantaged by the current lack of competition for wood fibre.

The most significant risks to biomass supply for new projects in the BDO Zone relate to the transportation phase of the supply chain. The current logging truck capacity in the region, which totals approximately 60 trucks and an equivalent number of drivers, is inadequate for the existing roundwood demand of ~800,000 GMT/yr. Regional chip truck capacity is also inadequate for the current sawmill residuals market in SW NS.

Timely and reliable delivery of the rated quantities of roundwood and residuals to a new project would likely require approx. thirty additional logging trucks, ten additional chip trucks, and an equivalent number of new drivers. Although financing for additional trucks is likely to be available, recruitment of new drivers and owner-operators will be challenging owing to difficulties insuring inexperienced Class 1 drivers and competing with alternative regions and industries for workers. Measures that might lead to successful recruitment of new drivers include reliable benefits packages offered by existing multi-truck companies (e.g., logging contractors and sawmills) and government or third-party training programs and incentives (Table F-1, Appendix F).

The risks associated with labour and equipment availability in the transportation phase are compounded by diesel price volatility, road infrastructure, and regulations. Roundwood transportation costs in Nova Scotia increased by 50% between 2017 and 2023 owing largely to elevated diesel prices. While continued volatility is inevitable and common to all regions of North America, the relatively low total annual demand for diesel in SW NS renders the region more susceptible to price volatility (although provincial regulations are designed to counteract this effect). The federal carbon tax and recently implemented Clean Fuel Regulations also add uncertainty regarding whether the rated quantities can be made available at the rated price ranges.

Concerning road infrastructure and regulations, transportation in the region can face limitations due to the density, condition, and weight designation of secondary and tertiary roads. In SW NS, there is a notable concentration of land designated as "remote-access" by the Nova Scotia Department of Natural Resources and Renewables (NS DNRR), signifying areas with low populations and very few roads or trails. Approximately 40% of roads in the supply basin have a maximum Gross Vehicle Weight (GVW) designation of 41.5 tonnes, significantly limiting the quantity of wood fibre that can be transported. This designation is attributed to inadequate road width, the presence of small bridges, and other factors that affect B-train and chip truck access. Special permits for additional weight allowances can be requested but many forestry professionals contacted by Ecostrat noted that permit requests are rarely granted.

Road infrastructure and regulations relevant to the forest industry in Nova Scotia continue to improve. The Government of Nova Scotia plans to spend over $1 billion on road and bridge infrastructure improvements over the next seven years. A major highway connecting the railway and port infrastructure of the Halifax region with SW NS (Highway 103) is in the process of being divided (expected project completion in 2028). A number of organizations continue to work towards increasing allowable weight limits, including the provincial government, the Forestry Economic Task Force, the Forest Nova Scotia Transportation Committee, and a forestry sector transition team. In 2019, the maximum allowable weight limits of a number of roads in SW NS were increased.

The distribution of forest resources available for new projects in SW NS imposes additional constraints on the transportation phase of the supply chain. The available low-grade roundwood supply for new bio-projects is widely dispersed across both private and public forests in SW NS (Map F-1, Appendix F). Accessing over 70% of the available roundwood may require procurement from distances greater than 120 km from Caledonia, NS.

Land ownership structures and provincial regulations relevant to biomass supply constitute another elevated risk. Roundwood sourced from smaller private woodlots could comprise as much as 60% of total wood fibre supply for a new project. Many forestry professionals contacted by Ecostrat expressed concern over changes in the willingness of small private landowners to harvest. Others were more optimistic about potential wood supply from smaller woodlots. The situation is mitigated to some extent by the presence of private and non-profit organizations that connect and mediate with private landowners, including the Western Woodlot Services Coop (WWSC), Freeman Lumber, and at least one large broker.

In the longer term (e.g., >5 years), an expected increase in partial harvesting and protected area prevalence in SW NS adds further uncertainty to wood supply from public lands. Resulting reductions in wood supply are accounted for by the third-party report that was used to estimate low-grade roundwood availability in the supply basin (see Section 3.5 and Appendix B).

Conversely, wood supply from private lands over the long-term may be adversely affected by forest harvest practices on some sites. Many areas of SW NS have shallow, acidic soils that are vulnerable to repeated biomass removal. Although partial harvesting on private lands has increased since the 1980s, over 50% of all harvesting on private lands in SW NS still involves clearcutting. The rated quantity of roundwood (400,000 GMT/yr) is expected to account for potential nutrient budget deficiencies, as it constitutes 75% of the total sustainable annual wood supply (Appendix B). This issue was assessed as a low-to-moderate risk to the rated quantity of biomass, but sustainability concerns and associated public opinion are noteworthy.

Finally, labour and equipment availability issues were also identified for the harvesting phase of the supply chain. To recover the full rated quantity of low-grade roundwood, harvesting activity would have to increase by 60-80% compared to harvesting activity over the 2016 to 2020 period. A scale-up in operations of this magnitude would require approx. twenty new crews and harvest equipment sets (1 x harvester, 1 x forwarder) (Appendix B). Achieving the required workforce increase is likely over a 5-10 year period but will be challenging to achieve in less than five years. Forestry workforce size in NS has been declining significantly since the 1990s (Figure F-4, Appendix F). Although the decline has begun to stabilize over the past few years – in part due to the growth of Freeman Lumber and its associated

contractor base – worker recruitment remains a problem.

Measures that are currently being pursued in the province to improve recruitment and equipment purchasing include the continued development of formal training/apprenticeship programs for equipment operators (e.g., the High Performance Logging initiative; Table F-1, Appendix F) and expanded coordination among sawmills, logging contractors, landowners, and intermediary governmental and non-profit organizations. There is already considerable experience and organizational capacity relevant to these measures. If the capacity and frequency of equipment operator training programs continue to grow, we expect that the required logging capacity will be in place within less than five years of project initiation.

### Infrastructure Profile

The four BDO Zone project development sites are clustered within Queens and Lunenberg counties (Appendix G). A major highway links the sites to the Halifax Regional Municipality (HRM) and its seaport, rail, and logistical infrastructure. Secondary and tertiary roads connect the working forest land base to wood processing facilities and major highways. The four sites have full access to essential utilities, including reliable electrical and water infrastructure, waste management systems, and modern telecommunications. A major hydroelectricity transmission project is expected to increase renewable electricity supply in the province to 40% by 2030. Dependable emergency services and efficient public works further contribute to a favorable business environment. Each of the four potential sites possesses unique attributes expected to contribute to the successful construction and operation of new value-added biomass-based manufacturing facilities.

### Project Director

D. Peter Wolf
Ecostrat Inc.
peter@ecostrat.com

### Infrastructure Analyst

Travis Taylor
Ecostrat Inc.
travis@ecostrat.com

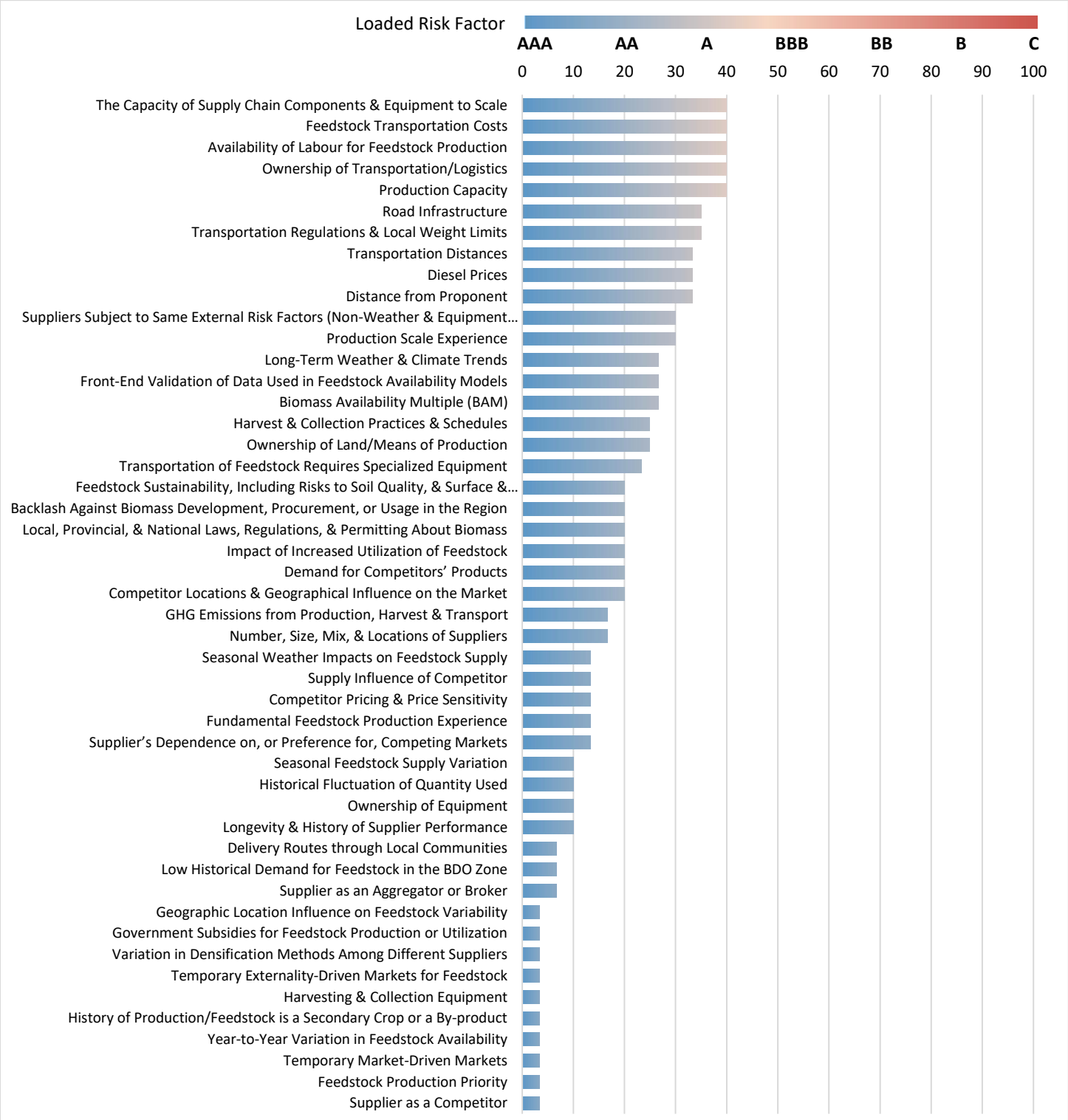
### Technical Contact

Marcin Lewandowski
Senior Director, Operations & Risk
Ecostrat Inc.
marcin@ecostrat.com

### Business Contact

Jordan R. Solomon
President & CEO
Ecostrat Inc.
jordan.solomon@ecostrat.com

## Figure 1: Risk Indicators (Sorted by Risk Level)



## Table 1: Risk Indicators and Associated Scores

| | Feedstock Supply Chain Risk Indicators | Raw RI Score | Notched Salience | Impact Level | Loaded RI Score |
|---|---|---|---|---|---|
| | **Category 1.0: Supplier Risk** | | | | |
| **1.1** | Longevity & History of Supplier Performance | 3 | 3.0 | 3.33 | 9.99 |
| **1.2** | Production Capacity | 6 | 6.0 | 6.66 | 39.96 |
| **1.3** | Supplier's Dependence on, or Preference for, Competing Markets | 2 | 2.0 | 6.66 | 13.32 |
| **1.4** | Supplier as a Competitor | 1 | 1.0 | 3.33 | 3.33 |
| **1.5** | Ownership of Land/Means of Production | 5 | 3.8 | 6.66 | 24.98 |
| **1.6** | Ownership of Equipment | 3 | 3.0 | 3.33 | 9.99 |
| **1.7** | Ownership of Transportation/Logistics | 6 | 6.0 | 6.66 | 39.96 |
| **1.8** | Supplier as an Aggregator or Broker | 2 | 2.0 | 3.33 | 6.66 |
| **1.9** | Distance from Proponent | 5 | 5.0 | 6.66 | 33.30 |
| **1.10** | Fundamental Feedstock Production Experience | 4 | 4.0 | 3.33 | 13.32 |
| **1.11** | Production Scale Experience | 6 | 4.5 | 6.66 | 29.97 |
| **1.12** | Feedstock Production Priority | 1 | 1.0 | 3.33 | 3.33 |
| | **Category 2.0: Competitor Risk** | | | | |
| **2.1** | Competitor Locations & Geographical Influence on the Market | 3 | 3.0 | 6.66 | 19.98 |
| **2.2** | Historical Fluctuation of Quantity Used | 3 | 3.0 | 3.33 | 9.99 |
| **2.3** | Competitor Pricing & Price Sensitivity | 2 | 2.0 | 6.66 | 13.32 |
| **2.4** | Supply Influence of Competitor | 2 | 2.0 | 6.66 | 13.32 |
| **2.5** | Temporary Market-Driven Markets | 1 | 1.0 | 3.33 | 3.33 |
| **2.6** | Demand for Competitors' Products | 3 | 3.0 | 6.66 | 19.98 |
| | **Category 3.0: Supply Chain Risk** | | | | |
| **3.1** | Biomass Availability Multiple (BAM) | 4 | 4.0 | 6.66 | 26.64 |
| **3.2** | Impact of Increased Utilization of Feedstock | 3 | 3.0 | 6.66 | 19.98 |
| **3.3** | Seasonal Feedstock Supply Variation | 3 | 3.0 | 3.33 | 9.99 |
| **3.4** | Year-to-Year Variation in Feedstock Availability | 1 | 1.0 | 3.33 | 3.33 |
| **3.5** | Front-End Validation of Data Used in Feedstock Availability Models | 4 | 4.0 | 6.66 | 26.64 |
| **3.6** | Low Historical Demand for Feedstock in the BDO Zone | 2 | 2.0 | 3.33 | 6.66 |
| **3.7** | History of Production/Feedstock is a Secondary Crop or a By-product | 1 | 1.0 | 3.33 | 3.33 |
| **3.8** | Diesel Prices | 5 | 5.0 | 6.66 | 33.30 |
| **3.9** | Harvest & Collection Practices & Schedules | 5 | 3.8 | 6.66 | 24.98 |
| **3.10** | Harvesting & Collection Equipment | 1 | 1.0 | 3.33 | 3.33 |
| **3.11** | Temporary Externality-Driven Markets for Feedstock | 1 | 1.0 | 3.33 | 3.33 |
| **3.12** | Variation in Densification Methods Among Different Suppliers | 1 | 1.0 | 3.33 | 3.33 |
| **3.13** | Availability of Labour for Feedstock Production | 8 | 4.0 | 9.99 | 39.96 |
| **3.14** | Feedstock Transportation Costs | 6 | 6.0 | 6.66 | 39.96 |
| **3.15** | Transportation Distances | 5 | 5.0 | 6.66 | 33.30 |
| **3.16** | Transportation of Feedstock Requires Specialized Equipment | 7 | 7.0 | 3.33 | 23.31 |
| **3.17** | Delivery Routes through Local Communities | 2 | 2.0 | 3.33 | 6.66 |
| **3.18** | Transportation Regulations & Local Weight Limits | 7 | 5.3 | 6.66 | 34.97 |
| **3.19** | Road Infrastructure | 7 | 5.3 | 6.66 | 34.97 |
| **3.20** | Number, Size, Mix, & Locations of Suppliers | 5 | 5.0 | 3.33 | 16.65 |
| **3.21** | Suppliers Subject to Same External Risk Factors (Non-Weather & Equipment Based) | 3 | 3.0 | 9.99 | 29.97 |
| **3.22** | Seasonal Weather Impacts on Feedstock Supply | 2 | 2.0 | 6.66 | 13.32 |
| **3.23** | Long-Term Weather & Climate Trends | 4 | 4.0 | 6.66 | 26.64 |
| **3.24** | Government Subsidies for Feedstock Production or Utilization | 1 | 1.0 | 3.33 | 3.33 |
| **3.25** | Local, Provincial, & National Laws, Regulations, & Permitting About Biomass | 3 | 3.0 | 6.66 | 19.98 |
| **3.26** | Backlash Against Biomass Development, Procurement, or Usage in the Region | 3 | 3.0 | 6.66 | 19.98 |
| **3.27** | Feedstock Sustainability, Including Risks to Soil Quality, & Surface & Groundwaters | 3 | 3.0 | 6.66 | 19.98 |
| **3.28** | GHG Emissions from Production, Harvest & Transport | 5 | 2.5 | 6.66 | 16.65 |
| **3.29** | Geographic Location Influence on Feedstock Variability | 1 | 1.0 | 3.33 | 3.33 |
| **3.30** | The Capacity of Supply Chain Components & Equipment to Scale | 8 | 6.0 | 6.66 | 39.96 |
| | | | | ***Average*** | **18.66** |




**Southwest Nova Scotia BDO Zone Independent Review Committee (IRC)**

**Rod Badcock** – Executive Director, Greenspring Bioinnovation Hub
**Greg Brown** – Economic Development Officer, Town of Bridgewater
**Erin Lowe** – Economic Development Officer, Municipality of the District of Chester
**Dave Waters** – Director of Economic Development, Municipality of the District of Lunenberg
**Richard Lane** – Director of Economic Development, Region of Queens Municipality
**Suzanne Fraser** – Investment Attraction Executive, Invest Nova Scotia
**Chris Bailey** – Director of Forestry, Nova Scotia Department of Natural Resources and Renewables
**Georg Ernst** – Business Development Manager, Harry Freeman & Son Limited
**Elizabeth Jessome** – Mi'kmaw Forestry Initiative Lead, Kwilmu'kw Maw-klusuaqn
**Breck Stuart** – General Manager, WestFor Management Inc.
**Harvey Gray** – Executive Director, Forestry Economic Task Force
**Patricia Amero** – General Manager, Western Woodlot Services Cooperative Ltd.
**Matt Miller** – General Manager, Medway Community Forest Cooperative
**Dennis Bedford** – Owner, Novon Forestry

# APPENDIX A: RISK INDICATOR SCORING METRICS

## CATEGORY 1.0: SUPPLIER RISK

### *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. | |
| **Raw RI Score:** The number of logging and trucking contractors operating in the supply basin decreased by >50% over the period 2001 to 2012 in response to declines in pulp and paper and lumber production.[1] In 2012, the closure of the only paper mill in SW NS (Bowater Mersey, Brooklyn, NS) significantly reduced demand for pulpwood in the region. A gradual downturn in lumber production and the closure of a paper mill located in Central Nova Scotia in 2020 (Northern Pulp, Abercrombie, NS) have led to further reductions in roundwood demand, workforce size, and cash flows. Trucking capacity has been most affected, in part due to the inability to shorthaul and backhaul as the number of buyers and sellers declines. Despite capacity declines, most logging contractors that remain involved in the SW NS forest industry have been in business for over twenty years. Sawmill business experience and performance also remains strong. A large family-owned sawmill (Harry Freeman and Son, hereafter Freeman Lumber) with a lumber production capacity of 135 million board feet (MMBF) is located within the supply basin and has been in business since 1832. The seven other sawmills in the supply basin were established before the 1990s.<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 9.99 out of 100. | **Score 9.99** |

### *1.2 Production Capacity*

| | |
|---|---|
| **Rationale:** Supplier production capacity can be a strong indicator of long-term credit worthiness and future solvency. Higher production capacities denote strength of operational elements, including cash flows, which are important to future solvency. | |
| **Raw RI Score:** Regional harvesting levels have been declining since the mid-2000s in response to market downturns and paper mill closures. Between 2000 and 2013, annual roundwood production in SW NS was halved. Since 2013, production has stabilized between ~750,000 GMT/yr and 1,000,000 GMT/yr (Figure B-1, Appendix B). During this more recent period, the production capacities of many suppliers have increased. The Freeman Lumber sawmill doubled its lumber production from ~50 MMBF to 110 MMBF between 2013 and 2023 and is planning for additional capacity upgrades.<br><br>Forest operations are fully mechanized, utilizing modern equipment required for cut-to-length harvesting (i.e., single-grip harvesters and forwarders). The pulpwood production capacity of a single logging crew (1-2 x harvesters, 1 x forwarder) is approximately 10-12 truckloads per week, or 12,000 – 15,000 GMT/yr.[2] | **Score 6** |

[1] Province of Nova Scotia. (March 2020). State of the Forest 2018. Department of Lands and Forestry. (p.11)
[2] Assuming that 30% of recovered roundwood is pulpwood, a 50-week work year, 30 GMT per truckload, and double shifted logging crews.

There are approx. 60 single-crew contractors that operate in the region and at least a dozen logging contractors present in the supply basin that employ 2-3 logging crews. An increase in partial harvesting over the past decade has had some impacts on productivity but this has been mitigated through operator experience, training, and aggregation/coordination functions provided by larger organizations, including a large Crown land management organization (WestFor), the largest sawmill in the region (Freeman Lumber), and a non-profit organization (Western Woodlot Services Cooperative, WWSC).

Regional trucking capacity continues to decline and represents a significant production capacity risk. Only about half of all logging contractors own logging trucks. There is therefore a dependence on independent trucking companies, all of which are single-driver, single-truck businesses. Companies that own multiple trucks are restricted to a few sawmills and some of the larger logging contractors. Trucking capacity in the region is inadequate for current harvesting activity, resulting in occasional roundwood delivery delays and the need to contract trucking services to companies in Central NS. Regional chip truck capacity is also limited. Risk is moderated to some extent by the fact that driver recruitment and truck purchasing will gradually increase if a new bio-project is built in the region. Overall, production capacity risk is deemed to be moderate-to-high owing to the current low production capacity of the region's trucking fleet.

Raw RI Score is 6 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 6.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100. | **Score 39.96** |

### *1.3. Suppliers' Dependence on, or Preference for, Competing Markets*

| | |
|---|---|
| **Rationale:** Suppliers may have a vested interest in or preference for supplying specific competitors for 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' dependences on competing markets to accept or purchase other products/by-products. Consequently, during periods of feedstock shortage, such suppliers may be more likely to allocate the scarce supply to a competitor, resulting in supply disruptions for the Proponent. | |
| **Raw RI Score:** Current demand and pricing for low-grade roundwood and sawmill residuals produced within the supply basin are significantly reduced relative to earlier periods. Markets for low-grade roundwood have been especially affected. Since the closure of the Bowater Mersey paper mill in 2012, approx. 200,000 – 300,000 GMT/yr of low-grade roundwood produced during conventional forest operations in the western portions of the supply basin has been left standing or felled and left on-site due to lack of proximal markets. In central and eastern areas of the supply basin, consistent demand for low-grade roundwood remained in place until 2020 when the Northern Pulp paper mill in Pictou County was closed. Current consumers of low-grade roundwood produced within the supply basin are restricted to Maibec CanExel (which consumes hardwood pulpwood only) and firewood buyers. Purchases of roundwood by a 28 MW biomass power plant (Brooklyn Power) have been infrequent and have not exceeded 20,000 GMT/yr in any given year since operations commenced in 2013. Average annual low-grade roundwood consumption by the facility between 2013 and 2023 is estimated to be <4,000 GMT/yr. | **Score 2** |

| | |
|---|---|
| Over 85% of sawmill residuals produced within the supply basin are currently sold to the 28 MW biomass power plant at prices <$35/GMT FOB for wood chips and <$20/GMT FOB for sawdust, shavings, and bark. All sawmill owner-operators contacted by Ecostrat, including Freeman Lumber, have expressed interest in supplying sawmill residuals to a new project for a modest premium. Port Hawkesbury Paper (PHP) is currently the most significant consumer of residuals in the province but is located >350 km away from the supply basin. Due to the excessive transportation distance and cost, opportunities to sell to PHP are largely restricted to product exchanges (e.g., transfers of sawmill residuals or pulpwood in exchange for sawlogs).<br><br>Raw RI Score is 2 out of 10. | |
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* Since there is established local demand for pulpwood and sawmill residuals, there is uncertainty as to whether existing competitors will be willing to increase prices if a new project becomes operational. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 13.32 out of 100. | **Score 13.32** |

### *1.4. Supplier as a Competitor*

| | |
|---|---|
| **Rationale:** The risks of feedstock costs going up and availability going down increase if a supplier is also a competitor to the Proponent. In times of feedstock shortage, the risk that supply commitments will not be met increases. | |
| **Raw RI Score:** Many logging contractors in SW NS retain a proportion of annual hardwood roundwood production for sale on the firewood market. The annual quantity sold on the firewood market is negligible compared to that sold on the sawlog market and it is unlikely that firewood demand will increase significantly. Sawmills in the region typically use some proportion of residuals (particularly shavings, and to a lesser extent bark) for internal energy needs (e.g., kiln drying, space heating). It is unlikely that sawmills will significantly increase their use of residuals for these purposes and therefore there is high confidence in the availability of the rated quantity of sawmill residuals and low risk of competition with suppliers.<br><br>Raw RI Score is 1 out of 10. | **Score 1** |
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *1.5. Ownership of Land/Means of Production*

| | |
|---|---|
| **Rationale:** Suppliers that own land where feedstock is produced, or a production facility, tend to have better control of supply chains and present lower degrees of supply risk. | |
| **Raw RI Score:** Over the past five years, the majority (~75%) of wood supply in the supply basin has been procured from the ~650,000 hectares of privately-owned working forests through stumpage payments. Private working forest is distributed among approx. 5,000 smaller woodlot owners (average woodlot size of ~100 ha), brokers and larger woodlot owners that own or manage ~1,000 – 5,000 ha, and at least three | **Score 5** |

entities that own large tracts of forested land (>10,000 ha and up to 50,000 ha in size).[3] There is moderate risk associated with procuring low-grade roundwood from new harvesting activity on smaller private woodlots. Many informants expressed concern over changes in the willingness of small private landowners to harvest. Others were more optimistic about potential wood supply from smaller woodlots. The situation is mitigated to some extent by the presence of private and non-profit organizations that connect and mediate with private landowners, including the Western Woodlot Services Coop (WWSC), Freeman Lumber, and at least one large broker. Wood supply from larger tracts of private working forest is associated with low risk.

The remaining portion of SW NS wood supply over the past five years (28%) has been procured from publicly owned ("Crown") land. Most of the wood supply from Crown land (>95%) comes from the 300,000 – 390,000 ha of working forest under the management of WestFor Management Inc. Since its establishment in 2016, WestFor has allocated sustainable wood supply to the region's mills on the basis of one-year wood supply agreements with the Department of Natural Resources and Renewables (DNRR).[4] There are plans to increase the length of wood supply agreements between WestFor and the DNRR.[5] The remainder is sourced from approx. 35,000 ha of public land that is licensed to the Medway Community Forest Cooperative (MCFC) and the Mi'kmaw Forestry Initiative (MFI). With teams of foresters, planners, and other professionals, WestFor, MCFC, and MFI have a capacity to plan for and manage sustainable wood supply. The continued implementation of ecological forestry may also encourage private woodlot owners to harvest. The current license agreement between WestFor and DNRR remains annual and there is uncertainty as to whether provincial plans to increase the proportion of land area under protected status (i.e., off-limits to timber production) will reduce wood supply from Crown lands in SW NS. Therefore, risk associated with public ownership of land is assessed as moderate.

Raw RI Score is 5 out 10.

| | |
|---|---|
| **Notched Salience:** Initial delays in securing long-term pulpwood supply from private or public lands can be mitigated by focusing procurement efforts on sawmill residuals. Raw RI score is notched down 25%. Notched salience is 3.75. | **Score 3.75** |
| **Impact Level:** RI Impact level is deemed *moderate.* There is a moderate level of uncertainty regarding wood supply from smaller woodlots and publicly owned forests, particularly for the 200,000 GMT/yr expected to come from new harvesting activity. For private woodlots, detailed landowner surveys would be required to reduce uncertainty. For public lands under the management of WestFor, uncertainty remains regarding long-term licensing agreements and the impact of protected area expansion on wood supply. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 24.98 out of 100. | **Score 24.98** |

### *1.6. Ownership of Equipment*

**Rationale:** In most cases, suppliers that own or lease equipment for harvest, collection, and processing feedstock are lower risk than those who do not. For example, third-party harvesting equipment may not

[3] Freeman Lumber, Minas Basin Pulp and Power, and Wagner Forest Management
[4] Referred to as Timber License Agreements (TLAs).
[5] There are on-going discussions around replacing WestFor's annual TLA with long-term Forest Utilization License Agreements (FULAs), which include 100-year planning horizons, 25-year tactical plans, and 5-year operating plans.

| | |
|---|---|
| be available when required. Short harvest windows may be missed if a farmer and contractor cannot schedule harvest times that are convenient and quantity shortages can result. | |
| **Raw RI Score:** Supply chain equipment critical for procurement of roundwood tends to be owned by logging contractors. A typical equipment profile for a logging operation in SW NS includes a single-grip harvester felling and processing trees into logs and a forwarder extracting logs to roadside. Logging trucks – which are either owned by the contractor or a third party – are then loaded and the roundwood is delivered to destination. Depending on age and condition, a single harvester or forwarder can cost as much as $500,000. As a result, business debt can often approach $1 million. The presence of larger entities willing to provide downpayment assistance mitigates risk to some extent (e.g., WestFor, Freeman Lumber).<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100. | **Score 9.99** |

### *1.7. Ownership of Transportation/Logistics*

| | |
|---|---|
| **Rationale:** In most cases, suppliers that own or lease equipment necessary to transport biomass from forest or field are lower risk than those who do not. However, in some circumstances, reliance on third parties to transport biomass is a common practice and does not contribute to risk. | |
| **Raw RI Score:** There are significant trucking capacity problems in SW NS, with long wait times and a need to contract to trucking companies located outside of the region (i.e., in Central NS). Fewer than four businesses in the region own more than four logging trucks (i.e., larger sawmills and logging contractors). Approximately half of the logging contractors in the region own a single truck. The lack of available trucks is largely explained by the lack of available third-party trucking companies in SW NS. As markets have declined, and opportunities for shorthauling and backhauling have disappeared, independent truckers have left the business. Recruitment of new drivers is challenging owing in part to difficulties insuring younger drivers. Chip truck capacity is also inadequate: SW NS operations must often enlist chip trucks from Sheet Harbour and Cape Breton. To ensure the rated quantities are delivered on time at a reliable cost, purchases of new trucks and recruitment of new drivers will be required.<br><br>Raw RI Score is 6 out 10. | **Score 6** |
| **Notched Salience:** No adjustment. | **Score 6.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* The availability of trucking capacity is limited in the region and will negatively impact the delivery of woody biomass to a new commercial biomass project. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100. | **Score 39.96** |

### *1.8. Supplier as an Aggregator*

| | |
|---|---|
| **Rationale:** Aggregators may effectively provide supply chain redundancy, eliminating the risk and complexity of dealing with multiple sources of supply by combining supplies into a single master contact. Aggregators can add much needed stability in BDO Zones by increasing offtake stability for both suppliers | |

| | |
|---|---|
| and markets. An aggregator can be a more reliable long-term offtake for suppliers by virtue of having multiple markets and can be a more reliable long-term supplier for markets by having access to multiple suppliers. Further, when a single supplier breaches, the aggregator can source from another. | |
| **Raw RI Score:** Freeman Lumber is a significant regional aggregator of roundwood and residuals. Both sawlogs and lower-quality roundwood are frequently stockpiled at its 150,000 GMT-capacity log yard in Greenfield, NS. Capacity utilization at the log yard is below 50% and storage capacity could be doubled if required. The sawmill has experience utilizing its large storage capacity for purposes of long-distance exchanges of roundwood; pulpwood is occasionally delivered to Port Hawkesbury Paper over 400 km away in exchange for sawlogs. The Western Woodlot Services Cooperative (WWSC) is another organization which plays an important aggregation role in the supply chain, connecting private landowners with logging contractors and mills. A large wood brokerage based out of Maine (HC Haynes Ltd.)) also functions as an important roundwood aggregator in the region.<br><br>Raw RI Score is 2 out of 10. | **Score 2** |
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100. | **Score 6.66** |

### *1.9. Distance from Proponent*

| | |
|---|---|
| **Rationale:** The greater the distance from a supplier to a plant, the more exposure to weather and fuel cost risks, and the greater the competitive pressure (to breach) that a closer competitor can exert. | |
| **Raw RI Score:** The available roundwood supply is widely distributed across private and public forests in SW NS.[6] Almost half (48%) of all low-grade roundwood available in the supply basin is within an 80 km road distance from Caledonia (the center point of the analysis), in the counties Queens, Lunenburg, and Annapolis (Figure F-1, Appendix F). All potential bio-project development sites also happen to be located within Lunenberg and Queens counties. Accessing >70% of the available roundwood supply requires procurement from distances greater than 120 km from Caledonia, including from Digby County, the county with the third largest roundwood supply potential in SW NS. Considering diesel price volatility (see 3.8), feedstock transportation costs (see 3.14), road infrastructure issues (see 3.19), and road regulations issues (see 3.18), the relatively even distribution of low-grade roundwood across the supply basin constitutes a moderate risk. Distance-related risks associated with sawmill residuals are insignificant: Freeman Lumber produces >95% of all sawmill residuals in the supply basin and is located 27 km from Caledonia and is within 40 km of three of the four potential development sites (the exception is Kaizer Meadow Industrial Park, located 90 km from Freeman Lumber).<br><br>Raw RI Score is 5 out of 10. | **Score 5** |
| **Notched Salience:** No adjustment. | **Score 5.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 6.66** |

[6] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp.

| | |
|---|---|
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 33.30 out of 100. | **Score 33.30** |

### *1.10. Fundamental Feedstock Production Experience*

| | |
|---|---|
| **Rationale:** Risk is higher when a supplier has limited experience with harvesting/processing and/or collecting biomass. Where experience is lacking, the Proponent should show that steps have been taken to ensure proper training, knowledge dissemination, and monitoring. | |
| **Raw RI Score:** In general, feedstock production experience in SW NS is substantial, as cut-to-length harvesting has been common in Nova Scotia since the 1980s. However, the prevalence of partial harvesting in SW NS has sharply increased over the past fifteen years owing to changes in government regulations and private woodlot owner preferences. In 2010, over 90% of harvesting in the region involved clearcutting or overstory removal. As of 2022, partial harvesting was responsible for nearly 60% of harvesting activity in the region. In virtually all forest operations on Crown land in the past few years, no more than 50% of canopy cover or basal area has been removed. Although most equipment operators are now trained and experienced in partial cutting, there are marginal economic disadvantages compared to clearcutting. Fixed costs inevitably increase as greater areas of land must be harvested to procure a given quantity (e.g., additional road building costs, machine movement costs). The production of sawlogs can also be reduced, as partial harvesting prescriptions often aim for removal of lower quality trees.[7] Long-term economic advantages of partial cutting, including maximization of sawlog production and growth and yield of shade tolerant and shade intermediate species (e.g., sugar maple, red spruce, white pine), are uncertain due to potential for natural disturbance over the long term. Forestry organizations in the region – including the Mi'kmaw Forestry Initiative (MFI) and WestFor – are working towards developing partial harvest prescriptions that balance economic and environmental objectives.<br><br>Raw RI Score is 4 out of 10. | **Score 4** |
| **Notched Salience:** No adjustment. | **Score 4.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 13.32 out of 100. | **Score 13.32** |

### *1.11 Production Scale Experience*

| | |
|---|---|
| **Rationale:** Number of years in business is a positive indicator of future solvency. Historical performance is an indicator of future performance. | |
| **Raw RI Score:** Risk associated with production scale experience relevant to the rated quantity of roundwood is assessed as moderate-to-high. Approximately 200,000 GMT/yr of low-grade roundwood can be recovered during conventional forest operations in the supply basin without scale-up; recovery will only require that equipment operators increase processed volumes per harvested area. However, procuring the additional 200,000 GMT/yr of low-grade roundwood will require an increase in harvesting | **Score 6** |

[7] Nova Scotia Innovation Hub-FPInnovations [NSIH-FPI]. August 2021. Feedstock Availability and Cost in Nova Scotia: By County and Specific Locations. Written by Kevin Blackburn, FPInnovations. 72 pp. (p.8); Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp.

activity by as much as 40%.[8] Recovering the total rated quantity would return regional roundwood production levels (including sawlogs, pulpwood, and low-grade roundwood) to levels sustained when the Bowater Mersey paper mill was operational in the early 2010s (~1.2 million GMT/yr).

Experience relevant to this quantity of production is available, as many of the logging contractors and sawmill operators in the region were working during this period. However, contractors may not have experience with the geographic scale of operations that is required to procure the rated quantities. Under ecological forestry regulations and increasing demands for partial cutting by private woodlot owners, as much as 60% of the rated roundwood supply could come from partial harvesting operations. Since partial harvesting yields lower roundwood quantities per hectare, an annual operating area comparable to that required for the rated quantity has likely not been experienced since the early 2000s, when roundwood production levels (largely from clearcut operations) were ~1.8 million GMT/yr. There is no risk associated with sawmill residuals production capacity experience.

Raw RI Score is 6 out of 10.

| | |
|---|---|
| **Notched Salience:** Milling and logging contractor capacity has been growing in recent years owing in part to active contractor recruitment and equipment financing by larger sawmills in the region. Continued efforts to increase recruitment, retention, and new equipment uptake are expected to reduce the risks associated with logging capacity. The High-Performance Logging (HPL) initiative of the Canadian Woodlands Forum, BioApplied, New Brunswick Community College (NBCC), and Forest Liaison has been in development since 2011. The objective of the initiative is to increase recruitment and retention of a skilled equipment operator workforce in the Maritimes by working closely with both skilled candidates and logging contractors interested in hiring and retaining entry-level machine operators. The NSCC and the Nova Scotia Apprenticeship Agency have also expressed interest in this model of workforce development. With regards to equipment uptake, continued willingness of Freeman Lumber and other organizations to offer favourable financing arrangements for logging contractors requiring new equipment would mitigate risks of production scale experience. No mitigation measures could be identified to mitigate trucking capacity risks. Raw RI Score is notched down 25%. Notched Salience is 4.5. | **Score 4.5** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 29.97 out of 100. | **Score 29.97** |

### *1.12. Feedstock Production Priority*

| | |
|---|---|
| **Rationale:** When biomass feedstock is a secondary or non-core line of business, or when it is a by-product or a residual from a more valuable primary product, then suppliers may not put in sufficient effort for consistent production. Risk of breach increases when production and/or delivery of feedstock compromises a supplier's ability to make a primary product. | |
| **Raw RI Score:** The production of low-grade roundwood is complementary to the production of high-quality roundwood (e.g., sawlogs). Recovering low-grade roundwood during conventional forest operations does not significantly reduce operational productivity and profit of logging contractors. There is therefore no | **Score 1** |

[8] Current sawlog production in SW NS totals ~700,000 GMT/yr and procuring the additional 200,000 GMT/yr of low-grade roundwood from new harvesting activity would yield approx. 300,000 GMT/yr of additional sawlog production (assuming a 60/40 sawlog/pulpwood recovery). Assuming that sawlog production is proportional to harvested area, the increase in sawlog production from 700,000 GMT/yr to 1,000,000 GMT/yr (700,000 GMT/yr + the additional 300,000 GMT/yr) represents a 43% increase in annual sawlog production and annual harvesting activity.

| | |
|---|---|
| risk that the rated quantity of pulpwood will become compromised due to a reduced ability to produce higher value sawlogs. There is also no feedstock production priority risk associated with sawmill residuals. | |
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

## CATEGORY 2.0: COMPETITOR RISK

### *2.1. Competitor Locations and Geographical Influence on the Market*

| | |
|---|---|
| **Rationale:** Competitors' locations relative to a Proponent plant can affect the viability of procuring feedstock and its cost. Accurate and detailed competitor mapping provides an understanding of the geographical influence a competitor may have, including competitive advantages such as short hauling. | |
| **Raw RI Score:** Seven competitors for wood fiber were identified within the competition zone. Three competitors are located within 150 km of the center point (Map E-1, Appendix E). The most significant competitor is a 28 MW biomass power plant (Brooklyn Power Corp.), which is located within ~50 km of the center point. The facility has been purchasing the majority of the sawmill residuals (mainly bark) produced by SW NS sawmills and has an estimated annual biomass demand of ~300,000 GMT/yr. Other competitors located within the supply basin include an engineered wood product manufacturer (Maibec CanExel) with a demand of ~100,000 GMT/yr of pulp-quality hardwood (95 km from center point) and a small biomass-based heating facility with demand <3,500 GMT/yr (120 km from center point). The two pellet mills in the province (located 185 km and 215 km from Caledonia) rarely pay enough to justify delivering residuals from SW NS sawmills. Competitors located >150 km from Caledonia generally do not procure wood fibre from Western NS.[9]<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* The extent to which Brooklyn Power will be incented to combust biomass under future RE regulations is uncertain, but negative public opinion of large-scale bioenergy in the province, procurement history, and the eventual need for facility refurbishment indicate that incentives for biopower in the province could be limited in the long term. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 19.98** |

### *2.2. Historical Fluctuation of Quantity Used*

| | |
|---|---|
| **Rationale:** Clear understanding of key competitors' consumption of each type of feedstock utilized by the Proponent is essential to quantifying the risks associated with each competitor. Understanding historical trends of feedstock utilization can provide valuable information about feedstock price elasticity during shortages and insights into events impacting future supply conditions. It can also enable more accurate | |

[9] Pulpwood/sawlog swaps between Freeman Lumber and Port Hawkesbury Paper occur infrequently

| | |
|---|---|
| estimates of the sensitivity of feedstock availability to potential future consumption levels or to the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change). | |
| **Raw RI Score:** Brooklyn Power Corp. operates a 28 MW biomass power plant in Brooklyn, NS that is owned by Emera. The company sells the electricity it generates from the combustion of sawmill residuals to Nova Scotia Power (NSP), a subsidiary of Emera.[10] There have been instances when low-grade roundwood was procured by the facility (e.g., in 2016/2017 and 2018/2019), but supplies are kept in inventory and represent a small fraction of annual wood fibre consumption (likely <4,000 GMT/yr of roundwood).<br><br>The most recent agreement between Nova Scotia Power and the Government of Nova Scotia guarantees payments for electricity up to 2027/28. The agreement was made following delays and operational problems with a hydroelectric generating station in Labrador (Muskrat Falls), which is connected to Nova Scotia by an undersea transmission line (Maritime Link). The Brooklyn Power facility was built in 1995 and will require significant investments in refurbishment. It is unlikely that renewable energy policies in the province will incent refurbishment or construction of a new biomass power plant given the expectations for the Maritime Link – Muskrat Falls project.<br><br>Other larger competitors in the region do not have a history of large wood fibre demand, including the finished wood product facility with a demand of ~100,000 GMT/yr of pulp-quality hardwood (Maibec CanExel) and two pellet plants with demands of ~200,000 GMT/yr (Great Northern Timber and Shaw Resources). Generally, risks related to historical fluctuations in biomass demand in the region are assessed as low.<br><br>Raw RI Score is 3 out of 10. | **Score** 3 |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact level is deemed *low*. | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 9.99 out of 100. | **Score 9.99** |

### *2.3. Competitor Pricing and Price Sensitivity*

| | |
|---|---|
| **Rationale:** Understanding how much competitors pay for different feedstock types is an essential step in determining competitiveness of Proponent. Historical prices paid by competitors provide insight into their procurement behaviors and ability/willingness to pay premiums for feedstock and exert pressure on Proponent's suppliers during times of feedstock shortage. Competitors who are able to offer higher prices for feedstock during feedstock shortages can pose significant risks to Proponent. | |
| **Raw RI Score:** Market prices for pulpwood and sawmill residuals in SW NS declined significantly following the closure of the Bowater Mersey paper mill in 2012 and have not recovered. The only current buyer of pulpwood in the region is Maibec CanExel which purchases ~100,000 GMT/yr of pulp-quality hardwood at a price of ~$65/GMT delivered. Brooklyn Power paid approximately $27/GMT for low-grade roundwood in 2018/2019 but has not purchased additional roundwood since this time. In comparison, delivered pulp-quality roundwood prices before 2012 typically exceeded $45/GMT and involved much larger quantities (>350,000 GMT/yr). | **Score 2** |

[10] Nova Scotia Utility and Review Board. (June 30, 2022). 2022 10-Year System Outlook. Nova Scotia Power. 60 pp. (p.17)

The two pellet mills in the province only buy roundwood in exceptional circumstances (e.g., when low-grade roundwood is available in surplus because of quotas at other mills or natural disturbances). Quantities accepted and prices paid are highly variable. Quotas on the quantity of biomass that buyers are willing to accept are common for biomass heating facilities, pellet mills, and other bioenergy facilities. Competitors in the region prefer lower cost sawmill residuals. Current prices for bark, sawdust, and shavings in the region range from approx. $5-$20/GMT FOB mill whereas wood chip prices range from $10-$35/GMT. Before the closure of Bowater Mersey in 2012, prices for wood chips in SW NS were as high as $60/GMT FOB. Due to the depressed pricing in the region and the lack of demand for lower-quality roundwood, risk is considered low.

Raw RI Score is 2 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** There is a moderate degree of uncertainty related to our understanding of competitors' price sensitivity. RI Impact level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 13.32 out of 100. | **Score 13.32** |

### *2.4. Supply Influence of Competitor*

**Rationale:** In some cases, competitors may be able to exert high degrees of pressure on local suppliers, effectively enabling them to control feedstock, especially during shortages. This control can derive from long previous relationships between suppliers and competitors, from verbal or "understood" agreements, or from a competitor being able to assist suppliers in times of surplus by maintaining large inventories that enable suppliers to continue supplying when other markets impose quotas. Understanding and planning around such soft risk factors is important. If such relationships exist in the Proponent's procurement area, they may indicate an increased risk of feedstock shortage or pricing changes.

**Raw RI Score:** Demand for sawmill residuals by Brooklyn Power Corp. has been inconsistent and prices offered have been significantly lower than prices paid for sawmill residuals and roundwood before the closure of Bowater Mersey in 2012 and Northern Pulp in 2020. All potential suppliers contacted by Ecostrat indicated that they are willing to sell to a new entrant for a modest premium. **Score 2**

Raw RI Score is 2 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* The Government of Nova Scotia could increase requirements for biomass electricity generation if the Maritime Link – Muskrat Falls project is not successful, thereby increasing annual biomass demand at the Brooklyn Power facility. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 13.32 out of 100. | **Score 13.32** |

### *2.5. Temporary Market-Driven Markets*

**Rationale:** Alternative, non-traditional, market-driven competitors for feedstock can increase feedstock demand in unusual circumstances.

| | |
|---|---|
| **Raw RI Score:** Freeman Lumber produces over 200,000 GMT/yr of sawmill residuals. Of this, it sends about 13,000 GMT/yr of sawdust and 6,000 GMT/yr of bagged shavings to non-traditional markets, mainly for animal bedding in Annapolis County. None of the local experts contacted were aware of increasing markets for animal bedding in the region. No other possible risks associated with temporary markets were identified.<br><br>Raw RI Score is 1 out of 10. | **Score 1** |
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *2.6. Demand for Competitors' Products*

| | |
|---|---|
| **Rationale:** Increased demand for competitors' products can cause greater demand for feedstock by the competitor. For example, greater demand for biofuels due to a clean fuels policy can cause increased biofuel production by the competitor, thereby increasing demand for feedstock. | |
| **Raw RI Score:** There is moderate risk that the Brooklyn Power facility will increase its annual demand for sawmill residuals and roundwood as a result of policy changes. The Government of Nova Scotia has set a goal of 80% renewable electricity by 2030. The government has also recently fined Nova Scotia Power for failing to meet its target of 40% renewable electricity by 2020, indicating that there is currently significant political will to achieve objectives.[11] A major hydroelectric project in Labrador that is linked to Nova Scotia through an undersea transmission line is critical to achieving the renewable electricity target (40% by 2030), but has encountered technical setbacks since its initial construction in 2021. There are other factors that reduce incentives for expansion of biomass power production in the province, including on-going concerns over the sustainability of using wood for purposes of electricity generation and the requirement to refurbish the combustion unit (est. 1995). No other major risks associated with increasing demand for products produced by competitors in the region could be identified (e.g., pellets).<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact level is deemed *moderate* due to uncertainty regarding future renewable power generation from woody biomass in the province. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 19.98** |

## CATEGORY 3.0: SUPPLY CHAIN RISK

### *3.1. Biomass Availability Multiple (BAM)*

| |
|---|
| **Rationale:** Biomass Availability Multiple (BAM) indicates the degree of redundancy in a Proponent's supply chain. BAM is the ratio of biomass feedstock available to a project, at costs, timing, and in quality |

[11] https://www.cbc.ca/news/canada/nova-scotia/power-electricity-renewable-energy-tory-rushton-1.6809515

| | |
|---|---|
| feasible for the Proponent, divided by the project's feedstock requirement. BAM is a strong indicator of supply chain resilience when stressed by supply shortage and/or supplier breach. | |
| **Raw RI Score:** Of the total 400,000 GMT/yr of roundwood available for a new bio-project, approximately 200,000 GMT/yr could be recovered from existing logging activity in the supply basin (Appendix B). Additional harvesting activity would be required to procure the remaining 200,000 GMT/yr of the rated quantity. Using estimates of sustainable wood supply under ecological forestry produced by a third party in 2022, we estimate that a total of ~530,000 GMT/yr of low-grade roundwood is sustainably available for new projects in the supply basin.[12] For the rated quantity of 400,000 GMT/yr, the BAM for pulpwood is 1.33.<br><br>Methods used to estimate annual residuals production from sawmills in the supply basin were deliberately conservative to ensure that final estimates were below what is likely in reality (Appendix C). Combined with sawmill owner-operators' stated willingness to sell, the sawmill residual BAM of 1.55 provides assurance to new project developers that the rated quantity of 150,000 GMT/yr will be available at low risk. Previous BDO Zone studies have had higher BAM values **for** pulpwood (e.g., >1.5). Therefore, overall risk is assessed as moderate.<br><br>Raw RI Score is 4 out of 10. | **Score 4** |
| **Notched Salience:** No adjustment. | **Score 4.0** |
| **Impact Level:** Feedstock redundancy, or BAM, is an important variable when assessing feedstock supply feasibility, and its level can impact the biomass supply security for a commercial biomass project significantly. RI Impact level is deemed *high.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 26.64 out of 100. | **Score 26.64** |

### *3.2. Impact of Increased Utilization of Feedstock*

| | |
|---|---|
| **Rationale:** Feedstock utilization can change over time owing to expansion of existing facilities and construction of new facilities. Increased utilization can lead to higher prices, feedstock disruptions, shortages, or supplier breach. | |
| **Raw RI Score:** As the major consumer of woody biomass in the supply basin, capacity expansions at the Brooklyn Power Corp. biomass power facility are unlikely to occur (see 2.6). There are also no indications that the two pellet mills present in Central NS will increase capacity and increase prices sufficient to procure residuals and roundwood from SW NS.<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 6.66** |

[12] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp. *The third-party report was produced for the Forestry Economic Task Force (FETF) by the consulting group AFRY. The report estimated sustainably available roundwood supply for new projects in NS using NS DNRR production forecast data, assumptions related to volume reductions likely under ecological forestry, product recovery assumptions, and modeling of current demand for roundwood.

| | |
|---|---|
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 19.98** |

### *3.3 Seasonal Feedstock Supply Variation*

| | |
|---|---|
| **Rationale:** Biomass supply can present significant seasonal supply variations; combined with limitations associated with longer-distance transportation and storage, can lead to regional biomass supply imbalances and manifest in shortages and higher costs for Proponents. | |
| **Raw RI Score:** The Nova Scotia Forest industry operates year-round with few seasonal interruptions. Delays in roundwood deliveries can occur during the spring when tertiary roads are off limits to loggers without special permitting. Winters in Nova Scotia tend to be mild and do not slow forest operations. Road maintenance is required more often in the winter months but this is not expected to impede the ability of a new project to procure the rated quantities of biomass at the rated prices. Sawmills often carry higher inventories over the winter months to mitigate a slowing of supply through the spring.<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment | **Score 3.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 9.99 out of 100. | **Score 9.99** |

### *3.4 Year-to-Year Variation in Feedstock Availability*

| | |
|---|---|
| **Rationale:** Biomass can have significant fluctuations in year-to-year supply due to variability in yield from biomass harvesting operations. | |
| **Raw RI Score:** Year-to-year variation in roundwood yield is not expected to be significant in the study region. As in other regions of North America, there has been a long-term decline in roundwood yield per unit area harvested but this has stabilized under modern forestry practices.<br><br>Raw RI Score is 1 out of 10. | **Score 1** |
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *3.5. Front-End Validation of Data Used in Feedstock Availability Models*

| | |
|---|---|
| **Rationale:** Feedstock supply models can be complex. Lack of clarity about model assumptions and baseline data can result in confusion on the part of the capital markets and drive financing costs for biomass projects. The adequacy and credibility of assumptions and baseline data is paramount to credible model outputs. | |
| **Raw RI Score:** Biomass availability estimates were developed using a mix of extrapolations from published sources, conversion factors, third-party availability estimates, and a spreadsheet model (Appendix B). To | **Score 4** |

estimate the quantity of low-grade roundwood available for new projects in the region, data presented in a recent wood supply study commissioned by the Forestry Economic Task Force (FETF) was used. The county-level data consists of pulpwood availability estimates by species for the unused portion of the sustainably available roundwood supply, as estimated in the NS DNRR's Sustainable Forest Analysis (SFA)/Provincial Timber Objective (PTO). The estimates were developed using the NS DNRR's forest inventory and therefore represent a reliable means of estimating availability.

To arrive at estimates of wood supply for new projects in the region, the total annual wood demand in SW NS (as estimated using the DNRR's *Registry of Buyers of Primary Forest Products* series) was subtracted from the total annual sustainably available wood supply (as estimated using NS DNRR modeling). Assumptions regarding the ratio of sawlogs-to-pulpwood were then introduced. This ratio can range from 80/20 to 40/60 in SW NS, depending on species composition and stand history. Most forestry professionals contacted by Ecostrat believed that a defensible sawlog/pulpwood ratio assumption was 70/30 or 60/40. Further details are provided in Appendix B.

The spreadsheet model used to estimate sawmill residuals production is simplified, involving the use of generic arithmetic factors that convert milled quantities of sawlogs to wood chips, sawdust, shavings, and bark. The model outputs were calibrated using an approach that is expected to result in underestimates of residuals availability (Appendix C). Therefore, there is low risk associated with sawmill residuals estimation. Overall, risk is assessed as low-to-moderate.

Raw RI Score is 4 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 4.0** |
| **Impact Level:** Because most of our conclusions in this assessment are based on biomass availability modelling, model errors can significantly impact supply chain risk. RI Impact level is deemed *high.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 26.64 out of 100. | **Score 26.64** |

### *3.6 Low Historical Demand for Feedstock in the BDO Zone*

**Rationale:** If the Proponent does not have a history of developing large-scale feedstock procurement, suppliers may not have sufficient expertise in feedstock production to ensure reliable supply, especially early on.

| | |
|---|---|
| **Raw RI Score:** Wood processing facilities (e.g., sawmills, paper mills) and supporting pulpwood and residual supply chains have been operating in the SW NS region for over 100 years. Larger sawmills in the competition zone have been steadily increasing capacity over the past decade. Contractors are experienced and can recover low-grade roundwood using conventional cut-to-length methods and equipment. Risk is assessed as low. | **Score** 2 |

Raw RI Score is 2 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** RI Impact level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100. | **Score** |

| | |
|---|---|
| | **6.66** |

### *3.7 History of Production/Feedstock is a Secondary Crop or a Byproduct*

| | |
|---|---|
| **Rationale:** If the 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, and producers may be less likely to prioritize production. If the feedstock is a secondary crop, then production can be subject to variables beyond suppliers' control. | |
| **Raw RI Score:** We do not anticipate any risks related to this risk indicator, as explained in 1.12.<br><br>Raw RI Score is 1 out of 10. | **Score**<br>1 |
| **Notched Salience:** No adjustment. | **Score**<br>**1.0** |
| **Impact Level:** RI Impact level is deemed *low*. | **Score**<br>**3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score**<br>**3.33** |

### *3.8 Diesel Prices*

| | |
|---|---|
| **Rationale:** Diesel, oil, and PPI can impact feedstock cost of harvest and collection over time. Sensitivities to worst case scenarios should be run. | |
| **Raw RI Score:** Roundwood transportation costs in Nova Scotia as reported by H.C. Haynes, Inc. increased by 51% between 2017 and 2023 as a result increasing diesel price.[13] After reaching a seven-year low in May 2020, diesel prices more than doubled in real terms between May, 2020 and Dec., 2022, increasing from $0.79/L to $2.20/L (2022 CAD). By May 2023, retail diesel prices returned to early 2013 levels (Figure F-3, Appendix F). Inherent diesel price volatility reduces confidence in a stable or downward trend over the long-term, particularly under climate policies like the federal carbon tax. The risk that diesel prices will push actual delivered roundwood and residuals prices in the BDO Zone beyond the upper limits of the rated price ranges is deemed moderate.<br><br>Raw RI Score is 5 out of 10. | **Score**<br>**5** |
| **Notched Salience:** No adjustment. | **Score**<br>**5.0** |
| **Impact Level:** RI Impact level is deemed *moderate* due to the uncertainty in the future price of fossil fuels under provincial, regional, and national climate policies. | **Score**<br>**6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 33.30 out of 100. | **Score**<br>**33.30** |

### *3.9 Harvest & Collection Practices & Schedules*

| | |
|---|---|
| **Rationale:** Differences in harvest timing and practices can create risks for both the quantity and quality of the 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. | |

[13] In 2017, the H.C. Haynes logging truck costing formula was: # of km * 0.07 + 7 ($17.5/GMT @ 150km). In 2023, the formula was: # of km * 0.11 + 10 ($26.5/GMT @ 150km).

| | |
|---|---|
| **Raw RI Score:** There is a moderate risk that the continued shift from clearcutting to partial harvesting could affect the quantity and quality of roundwood supplied to market. Partial harvesting reduces roundwood production per hectare, increasing variable costs and requiring a larger annual operating area and increases in associated road building, machine transport, and other overhead costs. Partial harvesting is also expected to reduce the quality of roundwood supplied to market, increasing the recovery of low-grade roundwood while decreasing the recovery of higher quality roundwood (e.g., sawlogs).[14] While this could be advantageous for a new bio-project, it also presents risks: reduced sawlog recovery could affect the profitability of logging operations and sawmills.<br><br>There are no other risks associated with harvesting practices and schedules. Roundwood and residuals supply chains operate continuously throughout the year with few weather-related interruptions. Road access limitations that occur in some areas during the spring are compensated for by scheduling spring harvesting in areas without road access limitations. With regards to feedstock quality, regional soft standards of log handling and storage ensure that variation in delivered feedstock quality and moisture content is within a range acceptable to buyers.<br><br>Raw RI Score is 5 out of 10. | **Score 5** |
| **Notched Salience:** The continued development of the High Performance Logging (HPL) initiative will mitigate risks associated with increased partial harvesting in the region. The machine operators program offered by New Brunswick Community College (NBCC) and an in-field operator training consultancy (Forest Liaison) under HPL provide training specific to partial harvesting systems. A number of other organizations in the province have expressed interest in developing similar programs or supporting the continued development of HPL, including the Nova Scotia Apprenticeship Agency and the Nova Scotia Community College (NSCC) – Lunenberg Campus. Together with traditional on-the-job training provided by logging contractors and equipment suppliers, such programs promise to increase equipment operator productivity in partial harvesting systems. Raw RI Score is notched down by 25%. Notched salience is 3.75. | **Score 3.75** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 24.98 out of 100. | **Score 24.98** |

### *3.10 Harvesting & Collection Equipment*

| | |
|---|---|
| **Rationale:** Different types of harvesting and collection equipment suppliers use can significantly impact the quality and availability of feedstock. The use of different types and combinations of harvesting, collection, and processing equipment can lead to non-homogeneous feedstock. In addition, equipment not designed specifically for biomass cultivation, harvesting, and collection can increase feedstock quality risks. | |
| **Raw RI Score:** None of the equipment used in the regional forestry supply chain constitutes a risk to wood fibre quality and availability. Trees are felled, delimbed, and sectioned into logs with harvesters. Logs are extracted to roadside with forwarders. Logs and residuals are delivered to destinations using conventional trucks. None of this equipment poses a feedstock quality or availability risk when managed and operated properly. | **Score 1** |

[14] Nova Scotia Innovation Hub-FPInnovations [NSIH-FPI]. August 2021. Feedstock Availability and Cost in Nova Scotia: By County and Specific Locations. Written by Kevin Blackburn, FPInnovations. 72 pp.; Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp.

Raw RI Score is 1 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact Level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *3.11. Temporary Externality-Driven Markets for Feedstock*

| | |
|---|---|
| **Rationale:** Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. | |
| **Raw RI Score:** Neither roundwood nor sawmill residuals are at risk of supply disruptions or sharp price increases resulting from shifts in alternative, non-traditional markets. Risk is assessed as low. | **Score 1** |

Raw RI Score is 1 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact Level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *3.12 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. | |
| **Raw RI Score:** Pulpwood and residuals are not densified for transportation and the existing suppliers are using similar logistics equipment and practices. Risk is low. | **Score 1** |

Raw RI Score is 1 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact Level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *3.13 Availability of Labour for Feedstock Production*

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

| | |
|---|---|
| **Raw RI Score:** Approximately 80 logging crews currently operate in the SW NS region. We expect that half of the rated quantity of low-grade roundwood (200,000 GMT/yr) can be procured by the existing workforce during conventional operations, without the need for additional harvesting activity or equipment operators. In the past five years, this quantity of low-grade roundwood has been left behind during conventional operations due to lack of markets and therefore can be easily recovered by the existing contractor base.<br><br>We expect that the remaining half of the rated quantity of roundwood (200,000 GMT/yr) will be procured from new harvesting activity that would not otherwise occur under existing markets. Current logging capacity is likely insufficient for this portion of the rated quantity. We estimate that an additional 20 logging crews (and an equivalent number of additional harvesters and forwarders) will be required to ensure the total rated quantity is recovered annually (Appendix B). Over a period of five years, logging capacity scale-up is likely to be successful with continued development of training programs, sawmill-contractor relations, co-financing arrangements, and stable demand for low-grade roundwood.<br><br>Labour availability risk is particularly high for the transportation phase of the supply chain. The number of truckers operating in SW NS has been declining rapidly in recent years, and most drivers are over the age of 40. Long wait times are common and there is often a need to contract trucking companies located in Central NS due to lack of available capacity in SW NS. The continued decline of the forestry workforce in the region over the past three years can be largely attributed to the exit of truckers.[15] Risk of labour availability is assessed as high.<br><br>Raw RI Score is 8 out of 10. | **Score 8** |
| **Notched Salience:** The continued development of the High Performance Logging (HPL) initiative will mitigate risks associated with increased partial harvesting in the region. The machine operators program offered by New Brunswick Community College (NBCC) and an in-field operator training consultancy (Forest Liaison) under HPL provide training specific to partial harvesting systems. A number of other organizations in the province have expressed interest in developing similar programs or supporting the continued development of HPL, including the Nova Scotia Apprenticeship Agency and the Nova Scotia Community College (NSCC) – Lunenberg Campus. In recent years, the Canadian Woodlands Forum (CWF) has also demonstrated a proof-of-concept forestry truck operator program in collaboration with Class 1 licensing in Nova Scotia. Together with traditional on-the-job training provided by logging contractors and some equipment suppliers, programs of this kind promise to increase workforce productivity, recruitment, and retention when adequately resourced. Raw RI Score is notched down by 50%. Notched salience is 4.0. | **Score 4.0** |
| **Impact Level:** RI Impact Level is deemed *high.* The success of worker recruitment programs remains highly uncertain, particularly for the truck operator workforce. | **Score 9.99** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100. | **Score 39.96** |

[15] FETF-AFRY estimate that 20-30% of current workers will leave the forest industry over the next five years; Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp. (p.78)

### *3.14 Feedstock Transportation Costs*

| | |
|---|---|
| **Rationale:** Transportation can be one of the most significant cost components of biomass supply chains. The average transportation cost and percentage of total feedstock cost attributable to transportation should be known. | |
| **Raw RI Score:** Transportation costs in the supply basin are approximately $0.18/GMT/loaded km, which works out to $26.50/GMT for the maximum transport distance of 150 km.[16] Although transportation costs have increased considerably in recent years, the contribution of transport costs to final delivered costs is less than 50% for the rated pulpwood price ranges for distances up to 150 km. Risk is assessed as moderate-to-high owing to diesel price volatility and continued logging truck and chip truck capacity shortages in the region.<br><br>Raw RI Score is 6 out of 10. | **Score 6** |
| **Notched Salience:** No adjustment. | **Score 6.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100. | **Score 39.96** |

### *3.15 Transportation Distances*

| | |
|---|---|
| **Rationale:** Transport distances of 50-100 km for biomass feedstocks are typical but larger distances can be common. When the average transport distance from suppliers to the Proponent 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 feedstock from competitors closer to the source. | |
| **Raw RI Score:** The available low-grade roundwood supply for new bio-projects is widely dispersed across both private and public forests in SW NS.[17] Nearly half (48%) of the available pulpwood supply is situated within an 80 km road distance from Caledonia, which serves as the center point of the analysis. These reserves are primarily concentrated in Queens and Lunenburg counties (where all potential project sites are located), and Annapolis County (as illustrated in Figure F-1, Appendix F). Accessing over 70% of the available roundwood necessitates procurement from distances exceeding 120 km from Caledonia, including areas with large supply potential like Digby County. Risks associated with diesel price increases, feedstock transportation costs, road infrastructure, and road regulations contribute to the moderate risk associated with transportation distance. No transportation distance risk is associated with sawmill residuals because of the close proximity between Freeman Lumber and the four potential bio-project development sites.<br><br>Raw RI Score is 5 out of 10. | **Score 5** |
| **Notched Salience:** No adjustment. | **Score 5.0** |
| **Impact Level:** RI Impact level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 33.30 out of 100. | **Score** |

[16] H.C. Haynes Ltd. (2023). Nova Scotia Wood Prices, July 16, 2023. Available at http://hchaynesnovascotiaprices.blogspot.com/
[17] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp.

| | |
|---|---|
| | **33.30** |

### *3.16 Transportation of Feedstock Requires Specialized Equipment*

| | |
|---|---|
| **Rationale:** Requirements for specialized transport equipment can increase supply chain risk. Where there is low availability in required transportation equipment, equipment owners have increased leverage over transportation prices and supply chain resiliency can be lower. | |
| **Raw RI Score:** Increasing annual pulpwood production in the region by 400,000 GMT/yr will require the purchase of additional trucks. Assuming 30 GMT per truckload, ~13,000 additional two-way pulpwood trips will be required annually. Assuming two trips per day and a 50-week work year, approximately 25 additional trucks would need to be added to the transport fleet in the supply basin to deliver the rated quantities of biomass. This represents a ~35% increase in current logging truck capacity (60-70 logging trucks). Transportation equipment risk is therefore assessed as moderate-to-high. Chip truck capacity scale-up will also be required to improve scheduling and wait times, but not to the same extent as for logging trucks.<br><br>Raw RI Score is 7 out of 10. | **Score 7** |
| **Notched Salience:** No adjustment. | **Score 7.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 3.33** |
| **Loaded RI Score** Loaded RI Score (Notched Salience × Impact Level) is 23.31 out of 100. | **Score 23.31** |

### *3.17 Delivery Routes through Local Communities*

| | |
|---|---|
| **Rationale:** Biomass transportation can become a nuisance to local communities, especially if large numbers of trucks pass through residential and school areas. Local communities often have the power to force regulations regarding truck transport, impeding a Proponent's ability to transport feedstock. This risk is greater in greenfield projects than operational ones. | |
| **Raw RI Score:** The four potential bio-project development sites are located in proximity to actively managed forests and wood processing facilities, including four sawmills and the Brooklyn Power Corp. 28 MW biopower facility. No risk from local communities is foreseen.<br><br>Raw RI Score is 2 out of 10. | **Score 2** |
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** RI Impact Level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100. | **Score 6.66** |

### *3.18. Transportation Regulations & Local Weight Limits*

| | |
|---|---|
| **Rationale:** In many regions, 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. | |
| **Raw RI Score:** Road weight limits are a constraint to the efficiency of wood fibre transportation in SW NS.[18] Road classifications of relevance to forest supply chains in Nova Scotia differentiate between maximum weight roads (62.5 tonnes Gross Vehicle Weight (GVW)), intermediate weight roads (49.5 tonnes GVW), and low weight roads (41.5 tonnes GVW). Lower weight roads reduce payloads from 25-33 GMT/truck to 18 GMT/truck. Special permits to increase GVW are available from the Department of Service Nova Scotia but local forestry professionals contacted by Ecostrat indicated that permit applications are seldom granted. As a result, logging trucks must often be routed around low weight roads, increasing transportation distance and cost. The Government of Nova Scotia continues to work towards increasing allowable weight limits wherever possible. In 2019, the maximum allowable weight limits of a number of roads in SW NS were increased. The current share of low weight roads in the SW NS road network remains significant at approx. 40%. Risk associated with transportation regulations and weight limits is assessed as moderate-to-high.<br><br>Raw RI Score is 7 out of 10. | **Score 7** |
| **Notched Salience:** Improving road infrastructure and weight limits is a stated objective of public and private forest sector interests in the province that is actively being addressed. The Government of Nova Scotia plans to spend over $1 billion on road and bridge projects between 2023 and 2030. Organizations such as the Nova Scotia Department of Public Works, the Forest Nova Scotia Transportation Committee, the Forestry Economic Task Force, the Greenspring Bioinnovation Hub, and a forestry sector transition team funded by the Government of Nova Scotia are working to continue increasing the coverage of maximum and intermediate weight roads in SW NS. Raw RI Score is notched down by 25%. Notched Salience is 5.25. | **Score 5.25** |
| **Impact Level:** RI Impact Level is deemed *moderate* due to the uncertainty associated with the transportation regulations and weight limits in the short and mid-term. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 34.97 out of 100. | **Score 34.97** |

### *3.19. Road Infrastructure*

| | |
|---|---|
| **Rationale:** Feedstock cost and availability can be a function of the accessibility of road infrastructure**.** Problems with road networks will translate directly to risks to feedstock supply. | |
| **Raw RI Score:** Primary highways in SW NS track the coastline and are undivided. A major infrastructure project involving the twinning of the major highway connecting Halifax County with Lunenberg, Queens, Shelburne, and Yarmouth counties along the southwest coast (Highway 103) is underway and expected to be completed by 2028. Secondary and tertiary roads in the region can impose constraints on efficient transportation owing to their NW-SE orientation (e.g., Highways 8, 10, and 12), condition, and weight designation. SW NS has one of the greatest concentrations of land classified as "remote-access" by the NS DNRR, which indicates areas with low populations and very few roads or trails.[19] Approximately 40% of these roads have a low weight designation (41.5 tonnes GVW maximum) due to inadequate width, the presence of small bridges, and other factors. Risk associated with road infrastructure is assessed as moderate-to-high. | **Score 7** |

[18] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp.
[19] Province of Nova Scotia. (2017). State of the Forest 2016. Nova Scotia Department of Natural Resources (DNR). Renewable Resources Branch. 90 pp. (p.68)

Raw RI Score is 7 out of 10.

| | |
|---|---|
| **Notched Salience:** Improving road infrastructure and weight limits is a stated objective of public and private forest sector interests in the province that is actively being addressed. The Government of Nova Scotia plans to spend over $1 billion on road and bridge projects between 2023 and 2030. Organizations such as the Nova Scotia Department of Public Works, the Forest Nova Scotia Transportation Committee, the Forestry Economic Task Force, the Forestry Sector Council, and a forestry sector transition team funded by the Government of Nova Scotia are working to continue increasing the coverage of maximum and intermediate weight roads in SW NS. Raw RI Score is notched down by 25%. Notched Salience is 5.25. | **Score 5.25** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 34.97 out of 100. | **Score 34.97** |

### *3.20. Number, Size, Mix, & Locations of Suppliers*

| | |
|---|---|
| **Rationale:** In general, a portfolio of multiple suppliers of various sizes is important for ensuring steady and uninterrupted feedstock supply with minimal price fluctuations. If a small number of large suppliers provide a high proportion of total feedstock, a disruption or supplier breach will have a greater impact on the supply chain. In such cases, the risk of disruption is lower, but the impact of those disruptions is higher. Conversely, a large number of small suppliers is less likely to have the capacity to withstand internal disruptions and may be more likely to breach. Here, the risk of disruption is higher, but the likely impact is lower. The number of suppliers and the ratio of small to large suppliers should be optimized. There is no pre-determined number or optimal ratio of suppliers—either too many or too few can pose higher degrees of risk. | |
| **Raw RI Score:** There is a significant disparity in the range of sawmilling capacities in the region. The Freeman Lumber sawmill (110 MMBF) produces over 85% of the sawmill residuals in SW NS. The next largest sawmill has a capacity of only 3.5 MMBF. There is therefore some risk associated with the size of suppliers in the BDO Zone, as any production decreases that result from operational slowdown or shutdown by Freeman Lumber cannot be compensated for by other suppliers.<br><br>The logging contractor population in the area is estimated at approximately 80 crews, or 160 to 240 operators. There are at least twelve larger contractors that have multiple crews and equipment complements available and therefore no significant risk associated with logging contractor size is foreseen. There is however some risk that roundwood supplies located in the counties of Shelburne and Yarmouth will be difficult to access, as most equipment operators in the region reside in areas that are greater than one hour drive distance from these areas. Some of the forestry professionals contacted by Ecostrat emphasized that one of the keys to worker retention in the region is to reduce work site travel times. | **Score 5** |

Raw RI Score is 5 out of 10.

| | |
|---|---|
| **Notched Salience:** No adjustment. | **Score 5.0** |
| **Impact Level:** RI Impact Level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 16.65 out of 100. | **Score** |

| | |
|---|---|
| | **16.65** |

### *3.21. Suppliers Subject to Same External Risk Factors (Non-Weather & Equipment Based)*

| | |
|---|---|
| **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 their locations, production practices, and other elements of supply chain structure such that the impact of single, high-risk events have varying impacts on suppliers. | |
| **Raw RI Score:** Suppliers operating in the SW NS BDO Zone are exposed to various common external risks relating to inputs (e.g., energy) and outputs (e.g., final product markets). These risks are common to all areas of North America and are considered low-to-moderate.<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact Factor is deemed *high.* Although unlikely, major economic shifts can have significant impact on the entire forest products industry in the BDO Zone. | **Score 9.99** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 29.97 out of 100. | **Score 29.97** |

### *3.22. Seasonal Weather Impacts on Feedstock Supply*

| | |
|---|---|
| **Rationale:** Seasonal weather impacts are defined as deriving from natural weather variations (e.g., spring thaws, rainy seasons, or dry seasons) as opposed to singular weather events (like fires, droughts, or hurricanes). Seasonal weather changes can be a significant risk factor affecting feedstock availability, quality, and price. | |
| **Raw RI Score:** Secondary and tertiary roads are typically closed to logging truck traffic for six weeks during the spring period (early-March to mid-April). This is compensated for by concentrating harvesting in areas with roads that are not affected by spring weather conditions and, in areas with roads that are affected, by ensuring a sufficient number of logging trucks are scheduled to transport harvested quantities before late-February/early-March. Wood supply risks from spring load restrictions are also mitigated by maintaining log yard inventories and transporting partial loads. Risk is assessed as low.<br><br>Raw RI Score is 2 out of 10. | **Score 2** |
| **Notched Salience:** No adjustment. | **Score 2.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 13.32** |

### *3.23. Long-Term Weather and Climate Trends*

| | |
|---|---|
| **Rationale:** In certain regions, climate trends and significant potential changes to future weather patterns can create feedstock risk. | |

| | |
|---|---|
| **Raw RI Score:** Forest fires are a common occurrence in SW NS. The large tracts of poorly stocked woodlands in SW NS are partly attributed to repeated fires.[20] However, total area burned has been declining since the 1920s, with significant interannual variation.[21] Hurricanes are also common on a decadal time scale and can have a significant impact on timber stocks on sites with shallow soils. Anthropogenic climate change may exacerbate forest fire and hurricane activity. Risk is deemed moderate owing to the greater vulnerability of SW NS to potential increases in forest fires and hurricane activity relative to other regions in North America.<br><br>Raw RI Score is 4 out of 10. | **Score 4** |
| **Notched Salience:** No adjustment. | **Score 4.0** |
| **Impact Level**: RI Impact Level is deemed *moderate* due to the uncertainty in the impact of climate change on the frequency of forest fires, hurricanes, and other natural disturbances. | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 26.64 out of 100. | **Score 26.64** |

### *3.24. 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. This risk indicator refers to direct feedstock subsides only; it does not apply to government subsidies that pertain indirectly to the operations of the Proponent, such as Loan Guarantees, or to the markets for products produced by the Proponent. | |
| **Raw RI Score:** No direct subsidies for feedstock production/utilization were identified.<br><br>Raw RI Score is 1 out of 10. | **Score 1** |
| **Notched Salience:** No adjustment. | **Score 1.0** |
| **Impact Level:** Raw RI Impact level is deemed *low*. | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *3.25. Local, Provincial, & National Laws, Regulations, & Permitting Pertaining to Biomass*

| |
|---|
| **Rationale:** Feedstock production directly dependent on local, provincial, or national laws or government regulations can pose greater long-term risk than feedstock that is not, since laws and regulations may be subject to amendment or repeal. If utilization of biomass requires specific permits (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. |

[20] Neily et al. (2017). Ecological Land Classification for Nova Scotia. Prepared by the Nova Scotia Department of Natural Resources. Report FOR 2017-13. (p.181)

[21] Taylor et al. (2020). A review of natural disturbances to inform implementation of ecological forestry in Nova Scotia, Canada. Environmental Reviews. 18 August 2020. https://doi.org/10.1139/er-2020-0015

| | |
|---|---|
| **Raw RI Score:** The maximum sustainable annual supply of roundwood as determined by the province's allowable cut limits (the Provincial Timber Objective) under ecological forestry regulations was used to inform selection of the rated quantity of roundwood.[22] There is low-to-moderate risk that allowable cut limits on Crown land will be reduced as a result of the planned increase in protected area coverage from 14% to 20% by 2030. The expected reduction in allowable cut levels on Crown land could have a moderate impact on the ability of a new project to procure the rated quantity of low-grade roundwood. No regulations relevant to biomass procurement from privately owned working forests were identified.<br><br>Raw RI Score is 3 out of 10. | **Score 3** |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 19.98** |

### *3.26. Backlash Against Biomass Development, Procurement or Usage in the Region*

| | |
|---|---|
| **Rationale:** Public backlash against biomass development in the Proponent region can directly impact Proponent's ability to procure, transport, trans-load, store, or utilize feedstock by affecting local policies, regulations, and Proponent's ability to obtain necessary permitting. | |
| **Raw RI Score:** Public opposition to the conduct of forestry operations on public lands is not considered a significant risk owing to the province's new ecological forestry regulations. However, on private lands, regulations that provide sustainability assurances are restricted to the Wildlife Habitat and Watercourse Protection (WHWP) Regulations, which require buffer zones around watercourses and wetlands and minimum tree and coarse woody debris retention levels. Partial harvesting and the associated retention of up to 75% of standing trees is not a requirement on private lands. Although partial harvesting has increased on private lands since the 1980s (particularly smaller woodlots), over half of forest operations on private lands still involve clearcutting (subject to the WHWP Regulations). Clearcutting is regarded by many stakeholders to represent a potential long-term risk to soil productivity and ecological integrity in certain areas of SW NS.<br><br>The risk of public opposition is also dependent on how recovered biomass is utilized and whether the Mi'kmaq of Nova Scotia are consulted regarding bio-projects that could impact rights or traditional use. Plans to use wood as a fuel in the province's fleet of coal power plants and in dedicated biopower facilities (notably the 28 MW Brooklyn Power unit in SW NS and the 60 MW Point Tupper unit in Cape Breton) have been met with some degree of negative public attention. There is therefore some risk that any future projects involving the conversion of logs into electricity will face negative public attention due to low energy conversion efficiencies and uncertain net carbon benefits. Projects that involve value-added products (e.g., liquid biofuels, engineered wood products, biochar) or high-efficiency energy conversion technologies (e.g., cogeneration, heating) are not a significant risk of negative public opinion in Nova Scotia. With regards to First Nations consultation, proponents of any new bio-project are advised to contact the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) to ensure that project scope and operations are acceptable. | **Score 3** |

[22] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp.

| | |
|---|---|
| Raw RI Score is 3 out of 10. | |
| **Notched Salience:** No adjustment. | **Score 3.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 19.98** |

### *3.27. Feedstock Sustainability, Including Risks to Soil Quality, & Surface & Groundwaters*

**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.

Soil sustainability can be defined as the management of soil in a way that does not exert any negative or irreparable effects on the soil or any other systems. There is a diversity of approaches to soil sustainability in jurisdictional guidelines for biomass harvesting and production. Different feedstock types have unique thresholds at which feedstock removal causes significant negative consequences on the soil.

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 a social and regulatory backlash. Water intake issues can also increase risk.

**Raw RI Score:** In Nova Scotia, there are public concerns around the environmental sustainability of forestry, particularly with regards to clearcutting and commercial use of wood for bioenergy applications. For public lands, these concerns have been addressed by the NS DNRR through the banning of full-tree harvesting (2013), development of ecological forestry practices that decrease clearcutting (2018), a commitment to increasing protected area coverage from 14% to 20% by 2030 (2021), and on-going development of long-term license agreements and planning horizons on Crown land. The province has also transferred control of a portion of Crown lands to organizations that aim to advance the concept of ecological forestry through smaller-scale approaches to production and marketing. Since 2015, approx. 35,000 ha of Crown land in SW NS has been transferred to the Mi'kmaw Forestry Initiative (MFI) of the Assembly of Mi'kmaw Chiefs (20,000 ha) and the Medway Community Forest Cooperative (15,000 ha). **Score 4**

Feedstock sustainability risk is heightened on private lands, where ecological forestry regulations do not apply. Although there has been a gradual shift towards partial harvesting on private lands since the 1980s, clearcutting remains common on private woodlots in SW NS. There have also been a few instances of full-tree harvesting in recent years. Some areas of SW NS may be sensitive to nutrient depletion resulting from repeated clearcutting, particularly lands south of Kejimkujik National Park, within and adjacent to the Tobeatic Wilderness Area. Full-tree harvesting would exacerbate nutrient depletion risk if it becomes more common. Due to the disproportionate contribution of private working forests to total wood supply and uncertainty regarding the long-term effects of clearcutting, risk of feedstock sustainability is assessed as moderate.

Raw RI Score is 4 out of 10.

| | |
|---|---|
| **Notched Salience:** The concept of ecological forestry and its relevance to balancing objectives at a landscape-scale is being actively articulated by many stakeholders at provincial and regional levels, including the DNRR, the Mi'kmaw Forestry Initiative (MFI), WestFor, and the Medway Community Forest Cooperative (MCFC), among others. A guiding principle of the Western Woodlot Services Cooperative (WWSC) – which provides advisory services to small private woodlot owners in SW NS – is that of sustainable forest management (including partial harvesting). Given recent trends in regulation and discourse around ecological forestry in the province, and given the number of organizations actively articulating and implementing the concept, we expect that an increasing proportion of private woodlot owners will adopt ecological forestry practices over time. Risk is notched down by 25%. Notched Salience is 3.0. | **Score 3.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100. | **Score 19.98** |

### *3.28. GHG Emissions from Production, Harvest, & Transport*

**Rationale:** Understanding a project's overall emissions and the carbon intensity throughout the feedstock supply chain is essential to reducing risks related to carbon pricing mechanisms and related regulations. Greenhouse gas (GHG) emissions from production, harvest, and transportation can be a significant challenge to Proponent claims of carbon neutrality for biomass projects. Carbon emissions from harvested soils, as well as emissions from harvesting machinery or delivery trucks, can make it difficult to achieve net-zero GHG emissions. If a Proponent's financial model relies on carbon neutrality/GHG regulatory pricing frameworks, it is essential to investigate the feedstock's carbon emission status.

| | |
|---|---|
| **Raw RI Score:** The GHG impacts of biomass-based projects depend largely on the type of product being produced. For bioenergy projects, the use of stemwood is generally understood to result in long carbon payback time horizons such that life cycle GHG emissions relative to fossil energy projects may increase (up to 100 years). In contrast, it typically takes less than 20 years for systems fueled with logging residues or sawmill residues to become carbon neutral/negative because waste products do not require accounting for re-growth of the trees from which they are procured. Due to the dependence of the SW NS BDO Zone rating on stemwood, there is a risk that a new bio-project (particularly a project converting biomass to electricity only) will be unable to classify as carbon neutral. However, a large proportion of low grade roundwood available from conventional forest operations is produced from trees with sawable sections. In these cases, roundwood could be treated the same as logging residues and sawmill residuals under GHG accounting protocols. Further, there is evidence that net GHG emissions from pulpwood recovered during existing operations could be reduced considerably relative to business-as-usual.[23]<br><br>Raw RI score is 5 out of 10. | **Score 5** |
| **Notched Salience:** Overall, there is significant uncertainty associated with carbon accounting and pricing frameworks globally. Renewable content mandates, clean fuel policies, and sustainable forest management schemes can support bio-projects that result in significant GHG emissions reductions compared to fossil fuels. Raw RI is notched down by 50%. Notched Salience is 2.5. | **Score 2.5** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score** |

[23] Steenberg et al. (2023). Life-Cycle Greenhouse Gas Emissions from Forest Bioenergy Production at Combined Heat and Power Projects in Nova Scotia, Canada. Forest Science 69(3): 286-298

| | |
|---|---|
| | **6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 16.65 out of 100. | **Score 16.65** |

### *3.29. Geographic Location Influence on Feedstock Variability*

| | |
|---|---|
| **Rationale:** Feedstock from different regions may differ in quality due to variations in soil quality, topography, harvest practices, weather, fertilizer applied, etc. | |
| **Raw RI Score:** There is no significant risk associated with feedstock quality variability resulting from geographic factors.<br><br>Raw RI Score is 1 out of 10. | **Score 1** |
| **Notched Salience**: No adjustment. | **Score 1.0** |
| **Impact Level:** RI Impact Level is deemed *low.* | **Score 3.33** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100. | **Score 3.33** |

### *3.30. 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 Proponent feedstock requirements and throughput capacity. Capacity to scale should be demonstrated. | |
| **Raw RI Score:** Half of the total rated quantity of low-grade roundwood is expected to be sourced from existing operations in the supply basin, as driven by lumber markets (Appendix B). The remaining half consists of standing low-grade roundwood that can only be procured by increasing harvesting activity. Recovering this additional 200,000 GMT/yr of low-grade roundwood would constitute a 60% to 80% increase in annual roundwood production in SW NS given harvesting levels over the 2016 to 2020 period (Appendix B). Approximately twenty additional logging crews, each consisting of two to three equipment operators and at least one single-grip harvester and one forwarder, will be required. Approximately thirty additional logging trucks and ten chip trucks will also be required to ensure the reliable and timely supply of wood fibre for a new project.[24]<br><br>There is a risk that logging and trucking capacity will be unable to scale-up to this extent owing to labour shortages, equipment shortages, and profit uncertainty associated with accessing marginal or distant stands. In the longer term (e.g., >5 years), an expected increase in partial harvesting and protected area prevalence in SW NS adds further uncertainty, as this will reduce production per hectare and will likely increase harvesting costs (which could impact available quantities). Although increased partial harvesting is accounted for in the third-party report that was used to select the rated quantity of low-grade roundwood, the data and assumptions underlying the model remain uncertain (see 3.5) and therefore risk is assessed as moderate-to-high.<br><br>Raw RI Score is 8 out of 10. | **Score 8** |

[24] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp. (p.14-15)

| | |
|---|---|
| **Notched Salience:** As identified by the Forestry Economic Task Force (FETF), **s**cale-up risks could be mitigated if current sawmill-contractor support measures, road infrastructure and regulation improvement initiatives, and provincial workforce policies and programs are strengthened.[25] Freeman Lumber has incrementally built its contractor base over the past five years in part through downpayment assistance and supply chain management. Continuing to improve relations between the mill and contractors will serve to reduce the debt burden of equipment ownership and improve operational efficiencies. Continued road infrastructure improvements and weight limit increases will have important long-term consequences for wood supply reliability and cost. Continued development of formal training programs (e.g., High Performance Logging) available for equipment operators and worker recruitment and retention programs would further mitigate risks of scale-up. Raw RI Score is notched down by 25%. Notched Salience is 6.0. | **Score 6.0** |
| **Impact Level:** RI Impact Level is deemed *moderate.* | **Score 6.66** |
| **Loaded RI Score:** Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100. | **Score 39.96** |

[25] Forestry Economic Task Force (FETF)-AFRY. (November 2022). Nova Scotia Forest Fibre Supply Analysis (Final Report). 105 pp. (p.14-15) (p.79)

# APPENDIX B: HARVESTING ACTIVITY AND AVAILABILITY OF ROUNDWOOD

## PULPWOOD AVAILABILITY FOR NEW PROJECTS IN SW NS

A recently published wood supply report for the province of Nova Scotia is used to inform the estimation of low-grade roundwood availability for a new project in SW NS.[26] The report, entitled 'Nova Scotia Forest Fibre Supply Analysis' (FETF-AFRY, 2022), estimated the total availability of roundwood using the province's estimation of sustainably available wood supply (the NS DNRR Provincial Timber Objective), which adjusts wood supply estimates on the basis of nutrient budget modeling, site access and operability, and other factors. This estimate was further adjusted by FETF-AFRY (2022) to account for the impact following the implementation of ecological forestry as recommended in the "Lahey Report", and given the current demand for roundwood. The rated quantity of roundwood (400,000 GMT/yr) is expected to account for potential nutrient budget deficiencies, as it constitutes 75% of the total sustainable annual wood supply. The province expects to provide an update to its sustainable supply calculations some time in late 2023 / 2024.

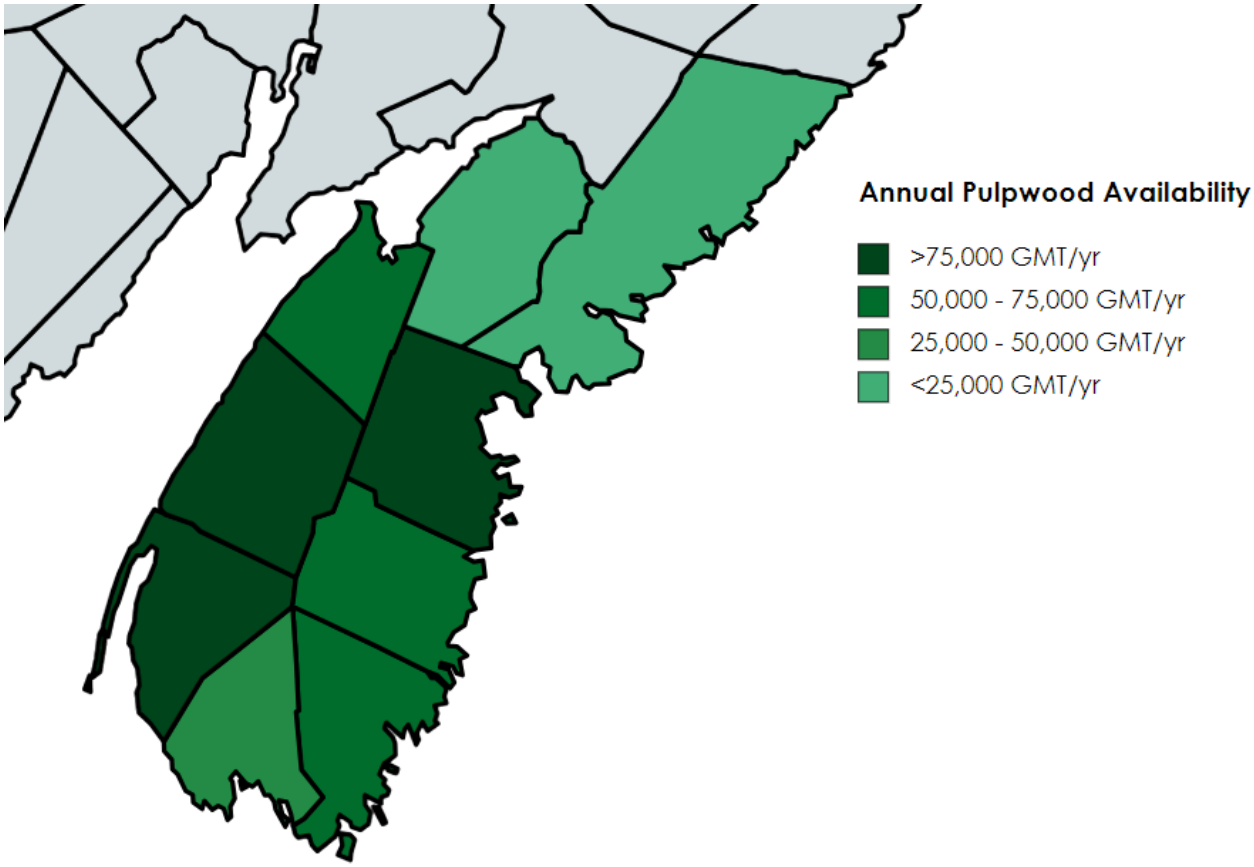
Sustainable wood supply estimates are provided at the county level and have been adjusted in Table B-1 to calculate the available volume within the supply basin – only partial volumes are included from Hants and Halifax counties, as only part of the supply basin falls within those areas. On that basis, we estimate that there is a surplus of 526,899 GMT/yr of low-grade roundwood ("pulpwood") available for new projects within the supply basin (Table B-1). With input from local forestry professionals, the final rated quantity of **400,000 GMT/yr**, or approximately 75% of the modeled availability, was selected to provide a conservative estimate of available roundwood volume to new projects. Using the ratios of modeled availability by species type (Table B-1), it is assumed that 60% of this total (240,000 GMT/yr) is comprised of softwood pulpwood and that 40% of this total (160,000 GMT/yr) is comprised of hardwood pulpwood.

**Table B-1: Low-grade roundwood (pulpwood) available from private and Crown lands within supply basin by county**

| County | Softwood pulpwood (GMT/yr) | Hardwood pulpwood (GMT/yr) | Percentage overlap of county with supply basin | Total pulpwood (GMT/yr) |
|---|---|---|---|---|
| Yarmouth | 25,219 | 18,444 | 100% | 43,663 |
| Shelburne | 37,183 | 22,916 | 100% | 60,099 |
| Digby | 47,250 | 30,252 | 100% | 77,502 |
| Queens | 34,783 | 35,995 | 100% | 70,778 |
| Annapolis | 49,490 | 35,923 | 100% | 85,413 |
| Lunenburg | 61,169 | 35,389 | 100% | 96,558 |
| Kings | 24,293 | 37,725 | 100% | 62,018 |
| Hants | 65,838 | 6,271 | 33% | 23,796 |
| Halifax | 30,694 | 23,709 | 13% | 7,072 |
| TOTAL | 345,225 | 222,915 | - | 526,899 |

[26] Low-grade roundwood available to a new project is defined as roundwood sectioned from tree stems and branches that either (1) cannot be utilized in the production of solid wood products (i.e., that cannot be utilized by a sawmill), (2) could be utilized for pulp and paper production but is not due to lack of markets, and (3) cannot be utilized in the production of pulp and paper products.

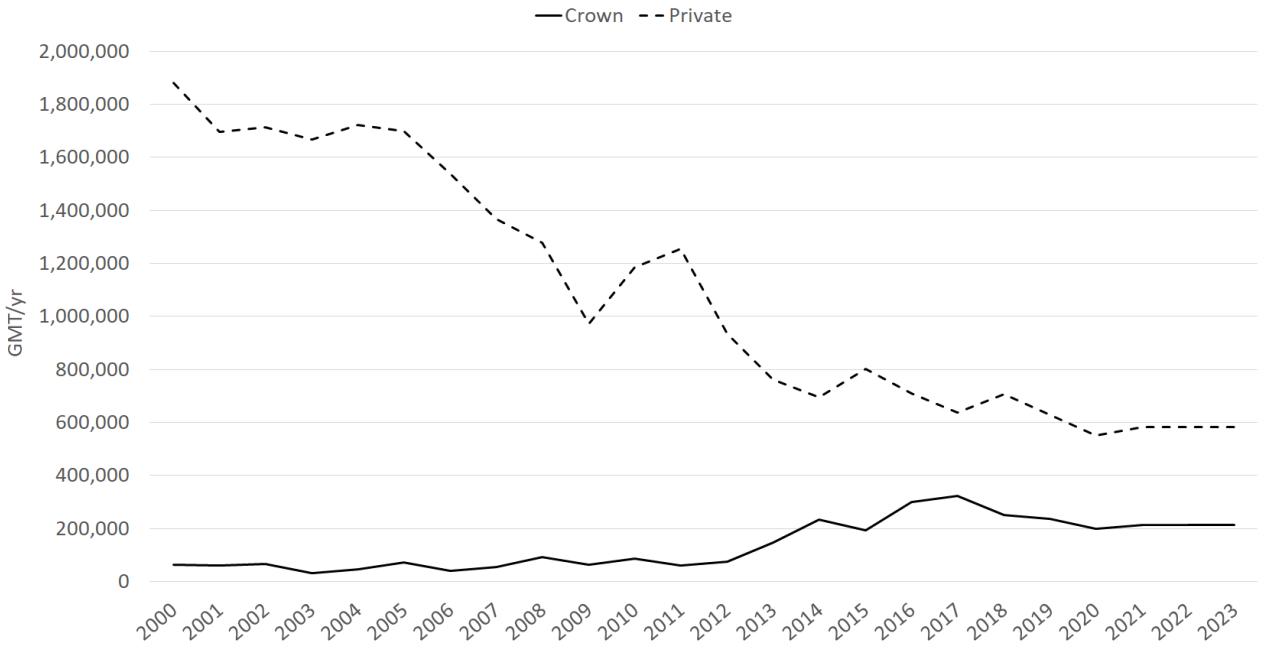
**Map B-1. Annual pulpwood availability in the supply basin by county**




## Pulpwood Production from Existing Harvesting Activity

The Nova Scotia Registry of Buyers of Primary Forest Products tracks annual roundwood flows in the province for buyers that purchase >5,000 $m^3$/yr. In the past three years, the total amount of roundwood purchased by buyers located in Western NS has averaged approx. 800,000 GMT/yr (75% private, 25% public) (Figure B-1). We estimate that 700,000 GMT/yr of this total consists of high quality roundwood (merchantable sawlogs) purchased by sawmills. Purchases of low-grade roundwood are restricted to a wood-based siding product manufacturer (Maibec CanExel), which has an annual consumption of ~100,000 GMT/yr. Other low-grade roundwood that could be brought to market during conventional forest operations is left in-woods following processing or left standing. To estimate low-grade roundwood that could be made available for new projects without additional harvesting, we assume that sawlog/pulpwood production ratios in the existing operations in SW NS average 70/30. For a 700,000 GMT/yr sawlog production, the total amount of pulpwood produced as a by-product of conventional forest operations is estimated at 300,000 GMT/yr. On the basis of this information, the availability of pulpwood from existing harvesting activity in the supply basin was set as **200,0000 GMT/yr**.

**Figure B-1: Roundwood supply from Crown and private lands in the supply basin, 2000-2020 (Nova Scotia Registry of Buyers of Primary Forest Products)**




## Pulpwood Production from New Harvesting Activity

The remaining **200,000 GMT/yr** of the rated quantity is expected to come from additional harvesting activity. Assuming that additional harvesting activity will involve more marginal stands, a sawlog/pulpwood ratio of 60/40 was selected for new harvesting activity. Using this assumption, procuring the additional 200,000 GMT/yr of low-grade roundwood would require an annual roundwood production increase of 500,000 GMT/yr (300,000 GMT/yr sawlogs, 200,000 GMT/yr pulpwood). This would represent a 60% to 80% increase in annual roundwood production in SW NS relative to average harvest levels between 2016 and 2020 but would remain below levels sustained over the 2000-2008 period. Accessing this material would require harvesting on an additional 3,000 ha/yr to 5,000 ha/yr of working forest (assuming roundwood production levels of 100 GMT/ha to 150 GMT/ha).

## Logging and Trucking Capacity Scale-up Requirements

We estimate that an additional 10 to 20 logging crews and an equivalent number of additional harvesters and forwarders would be required to secure the 200,000 GMT/yr of low-grade roundwood from new harvesting activity. This estimate assumes a logging crew productivity of 10-12 truckloads (25-30 GMT) of low-grade pulpwood per week and a 48-week work year. This would represent a 12.5% to 20% increase in logging capacity (current logging capacity in the supply basin is approx. 80 crews).

Given the current shortage of trucking capacity in SW NS, we estimate that trucking capacity would need to be increased by up to 25 logging trucks. This assumes an average payload of 30 GMT, two trips per day, 5 working days per week, and a 50-week work year. This would represent a ~35% increase in trucking capacity given current levels (60-70 logging trucks operate annually in the supply basin). Additional chip trucks will also likely be required to ensure timely delivery of sawmill residuals.

# APPENDIX C: SAWMILL RESIDUAL ESTIMATION

Sawmill residuals production in the supply basin was estimated through outreach to sawmills and local experts and using the Ecostrat sawmill residual model. Through outreach, we were able to obtain direct estimates of the annual production of wood chips, sawdust, shavings, and bark from Freeman Lumber. We were also able to obtain estimates of residuals production from three other sawmills from a forestry professional with experience working with these mills.

The sawmill residual model was used to produce estimates of wood chip, sawdust, shavings, and bark production as a function of lumber production (MMBF/year) for the remaining four sawmills. The model uses generic conversion factors for sawmills. The final residuals estimates must be adjusted using local data because of regional differences in log sizes and dimensions and sawmill product output and efficiency. The adjustment factors calculated for the four sawmills ranged from 0.30 to 0.57. A final adjustment factor of 0.4 was selected on the basis of that calculated for Freeman Lumber.

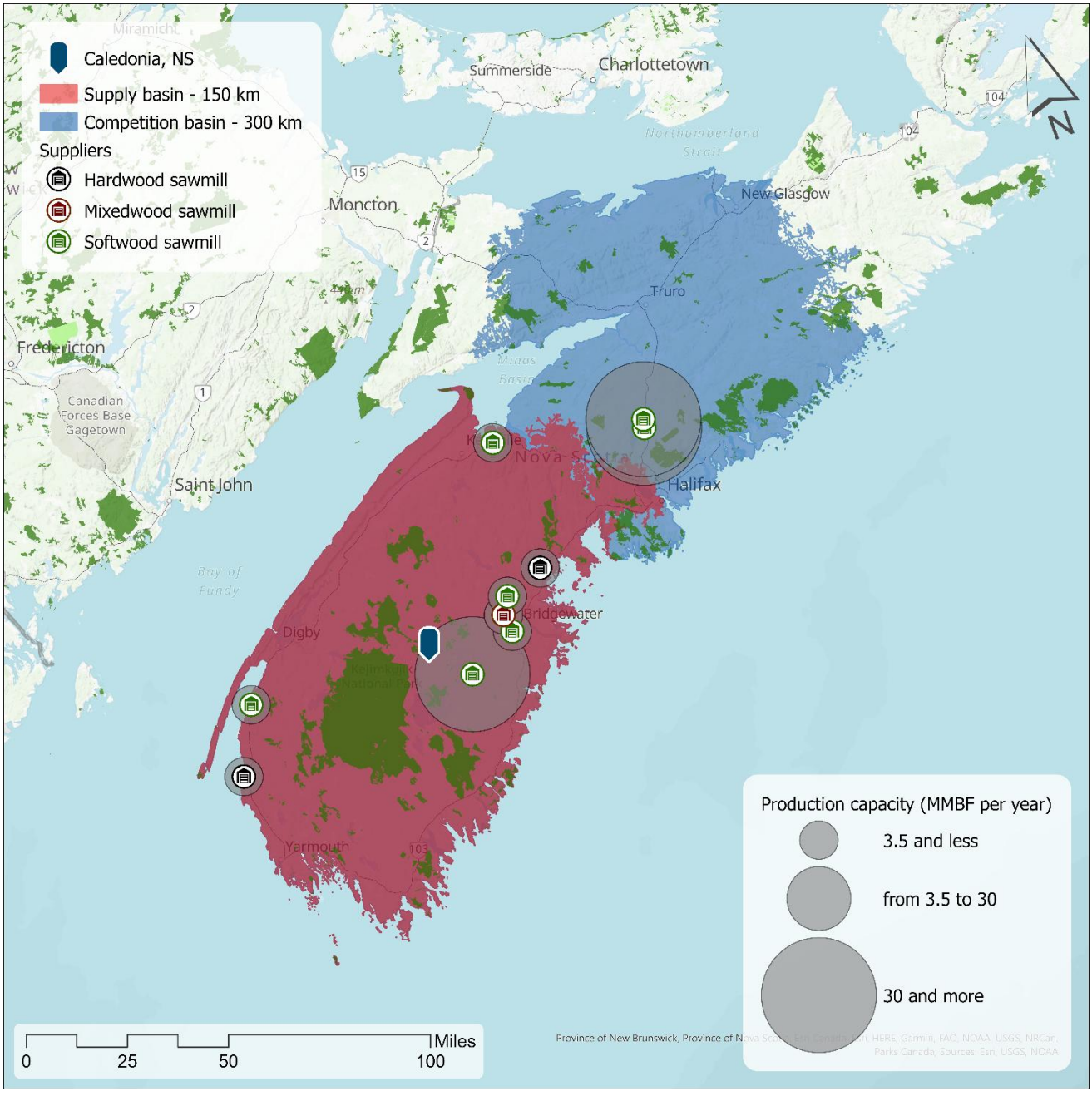
A final residuals availability estimate of 233,643 GMT/yr was calculated using this procedure (Table C-1). The final rated quantity of 150,000 GMT/yr effectively assumes a capture rate of ~65% for a new biomass-based project in the BDO Zone for the rated price of $25-$60/GMT. This assumption is supported by feedback received from sawmill owner-operators and by the extra milling capacity of Freeman Lumber, which is expected to increase annual availability of sawlogs by up to 300,000 GMT/yr as a result of increased harvesting activity for the rated quantity.

**Table C-1: Sawmill residuals quantity and price estimates**

| | Estimated total quantity (GMT/yr) *after applying 0.4 adjustment factor | Rated quantity (GMT/yr) | Rated price range ($/GMT FOB) |
|---|---|---|---|
| Wood chips | 153,958 | 100,000 | $40-$60 |
| Bark | 19,876 | 15,000 | $25-$35 |
| Sawdust | 32,701 | 20,000 | $25-$35 |
| Shavings | 27,108 | 15,000 | $25-$35 |
| Total | 233,643 | 150,000 | $25-$60 |

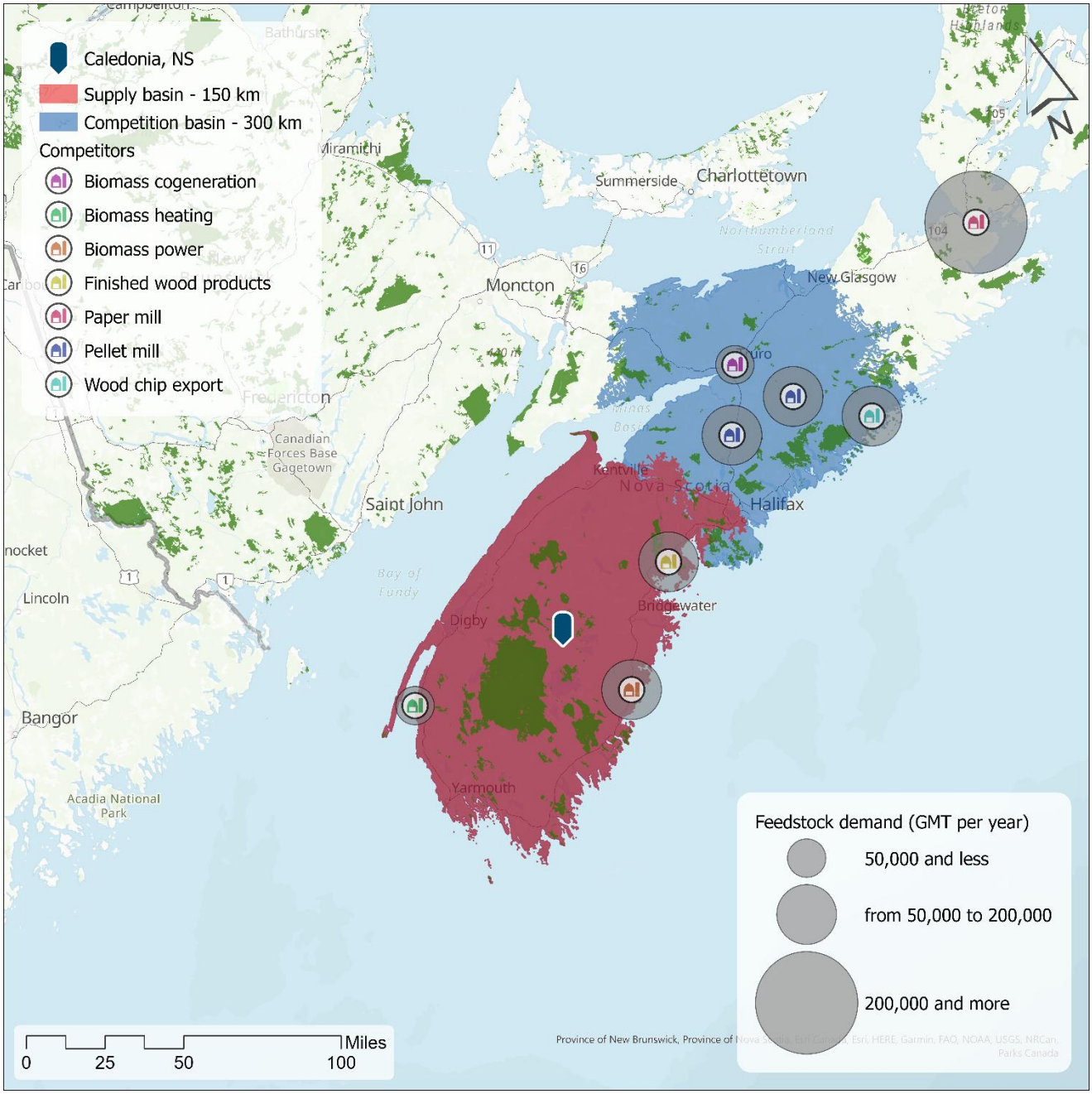
# APPENDIX D: SAWMILLS

**Map D-1. Sawmills within and adjacent to supply basin**



# APPENDIX E: CURRENT COMPETITION

**Map E-1. Current competitors for feedstock within 150-km drive distance from Caledonia, NS**



# APPENDIX F: OTHER CHARTS AND FIGURES

**Figure F-1: Biomass supply curve: potential availability as a function of distance from Caledonia, NS**

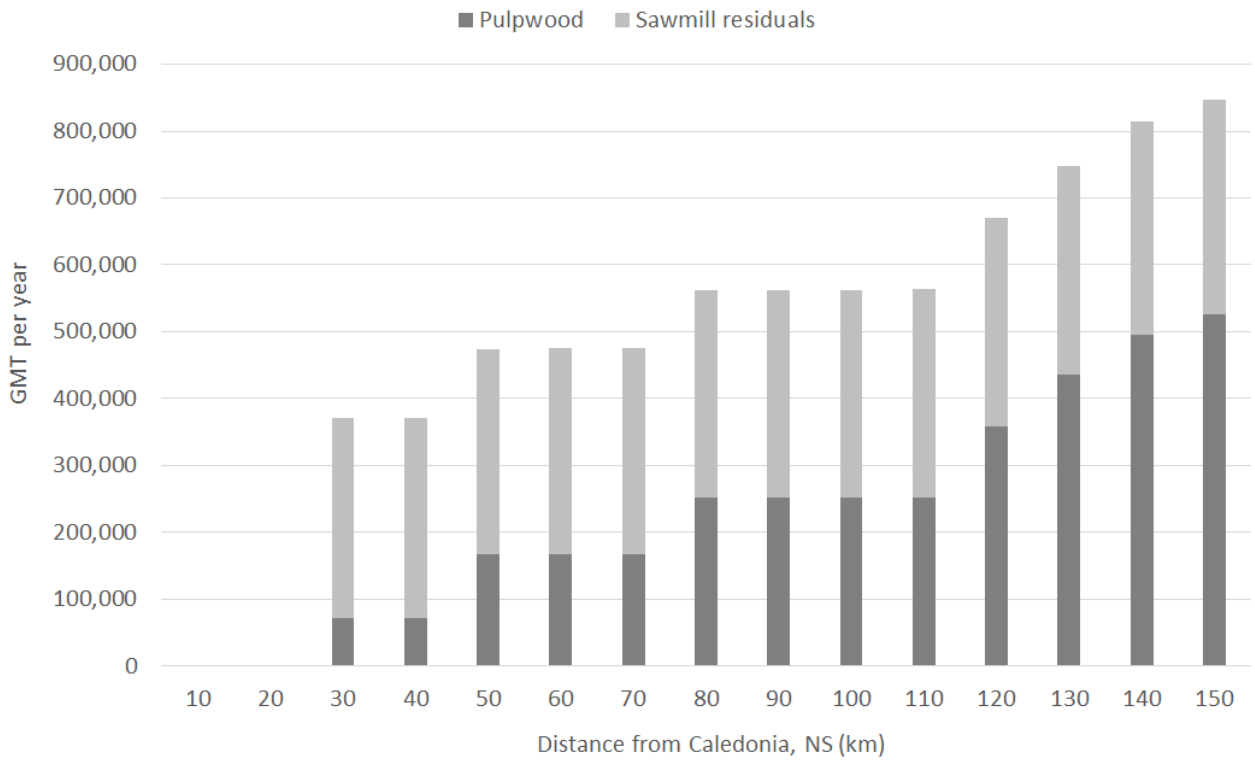



**Figure F-2: Nominal diesel prices in Halifax, Nova Scotia, 2013–2023**



**Figure F-3: Real diesel prices in Halifax, Nova Scotia, 2013–2023 (2023 CAD)**

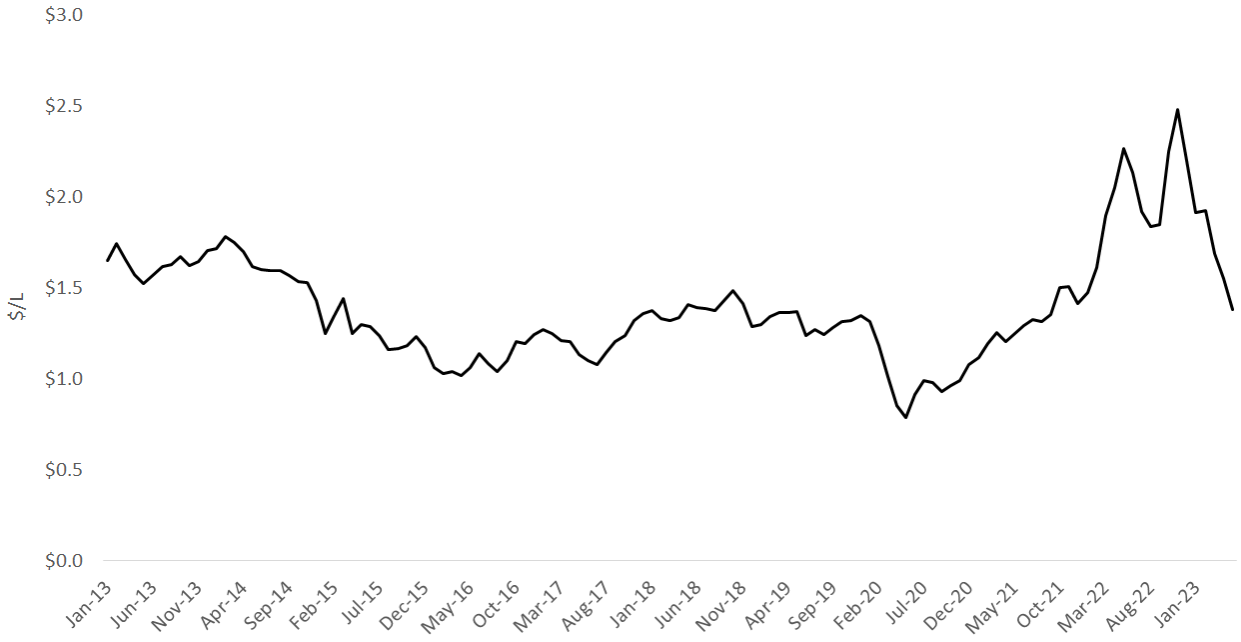
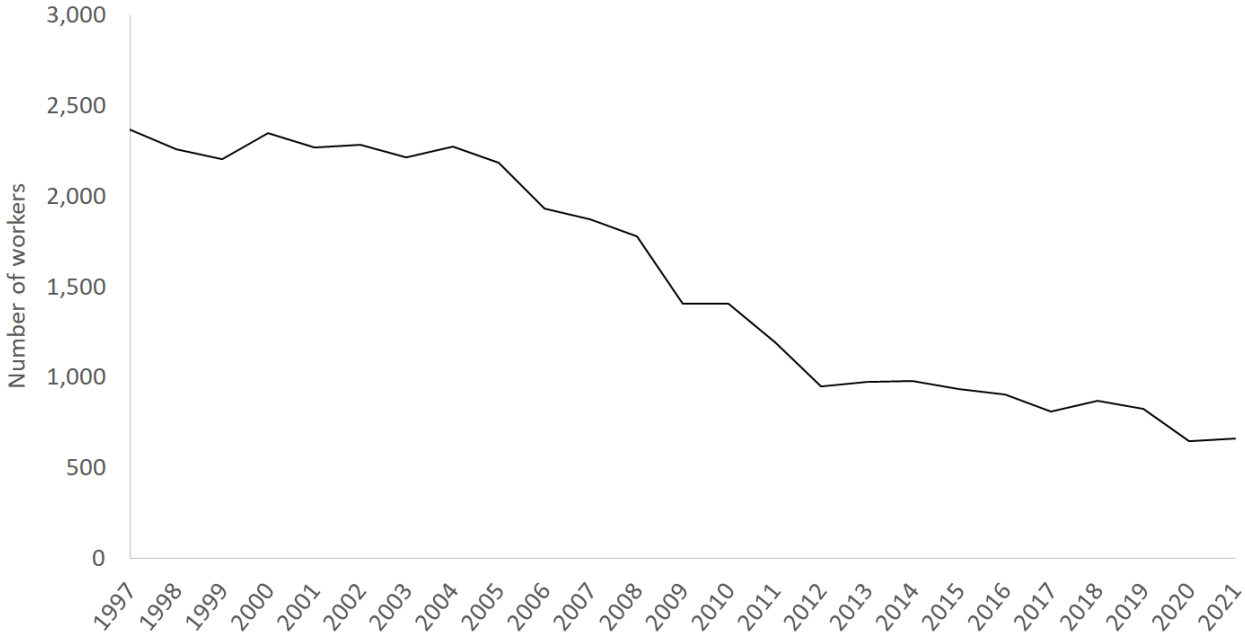



**Figure F-4: The size of the forestry and logging workforce in Nova Scotia, 1997-2021[27]**




[27] Source: Statistics Canada. Table 36-10-0489-01 (formerly CANSIM 383-0031): Labour statistics consistent with the System of National Accounts (SNA), by job category and industry. (accessed May 20, 2022).

**Table F-1: Forestry and logging workforce initiatives and programs available to Nova Scotians**

| Program / Initiative | Associated Organizations | Objective |
|---|---|---|
| Forest Machine Operator Program (High Performance Logging) | Canadian Woodlands Forum, BioApplied, Forest Liaison | Forest operations workforce development |
| Mechanized Forest Equipment Operator program | New Brunswick Community College (NBCC), High Performance Logging | Forest operations workforce development |
| Forestry Operator Training | Forest Liaison | Forest operations workforce development |
| Class 1 Driver – Tractor Trailer | Maritime Environmental Training Institute (METI) | Transportation workforce development |
| *Unnamed program currently in development | Nova Scotia Community College (NSCC), High Performance Logging | Forest operations workforce development |
| *Unnamed program currently in development | Nova Scotia Apprenticeship Agency, Canadian Woodlands Forum | Forest operations workforce development |
| *Unnamed program currently in development | Canadian Woodlands Forum | Transportation workforce development |

# APPENDIX G: INFRASTRUCTURE

## INFRASTRUCTURE OVERVIEW: SW NOVA SCOTIA

### *Evaluated Sites*

- Kaizer Meadow Industrial Park, District of Chester, Lunenberg County
- Bridgewater Business Park, Bridgewater, Lunenberg County
- Freeman Lumber, Greenfield, Queens County
- Port Mersey Commercial Park, Brooklyn, Queens County

### *Executive Summary*

The four SW NS BDO Zone project development sites are located within Lunenberg and Queens counties. Each site has unique attributes that are expected to contribute to the successful construction and operation of new biomass-based facilities. consultation with the Mi'kmaq of NS is recommended for any projects that could impact rights or traditional use. A simple statement to that effect would be a respectful signal and something that the Municipalities involved, as well as potential proponents, should consider whether it's legally required or not. Details are provided below ("Site Overviews"). All sites have access to the same core regional infrastructure and service, and share many site-level commonalities, including industrial zoning and on-site office, manufacturing, and warehouse space. The regional road network includes a primary highway (#103) that links SW NS to the seaport, rail, and logistical infrastructure of Halifax Regional Municipality (HRM). Secondary and tertiary roads connecting the working forest land base to forest processing facilities and major highways are frequently trafficked by the regional forest industry. The nearest intermodal railway and seaway access points are located in Halifax, 100 to 150 km from the evaluated sites.

Regional electricity generation and transmission capacity is owned and operated largely by Emera and its subsidiary Nova Scotia Power (NSP). Access to renewable energy is expected to continue expanding as the 824 MW Muskrat Falls hydroelectric generating station in Labrador comes online. The station is connected to Nova Scotia's transmission infrastructure via a major undersea transmission line (Maritime Link). The region and the four sites are well serviced by other essential utilities, including water, waste management systems, and modern telecommunications. The federal and provincial governments have been actively extending fibre optic coverage in the region in collaboration with Bell Canada. Dependable emergency services and efficient public works contribute to a positive business environment. Affordable living options, a moderate climate, an appealing coastal landscape, and a Maritime culture have resulted in net immigration, ensuring good workforce attraction.

### *Site Locations & Regional Access*

The four potential biomass-based project development sites are located in Lunenberg and Queens counties, in close proximity to primary and secondary highways relevant to the efficient transportation of primary forest resources (e.g., roundwood and sawmill residuals) and finished products (Map G-1). Primary and secondary roads are classed as maximum weight, permitting gross vehicle weights of up to 62.5 tonnes. Road infrastructure continues to improve as a result of federal and provincial infrastructure investment programs (see "Regional Infrastructure Investment"). The four sites are strategically located near highway #103, which connects the region to the rail and port infrastructure of HRM and is in the process of being upgraded. Given the lack of direct railway services in the region, new bio-projects will require intermodal containerized transport (drayage) of finished products in order to access the Canadian National Railway and Via Rail trunk lines located in HRM and which service Canadian and U.S. markets. Transloading logistics and infrastructure capacity in HRM is adequate for purposes of drayage. Reliable access to seaborne and air cargo transport is also made possible by

Highway #103. All sites are within 100-150 km of the Port of Halifax, a major international port that handles over 19 million tonnes of cargo annually. Halifax Stanfield International Airport is located 100-200 km from the evaluated sites and has an annual cargo capacity of over 41,000 tonnes.

**Map G-1. Locations of the four evaluated infrastructure sites in relation to major roadways and railways**




## *Regional Infrastructure Investment*

Major investments in road and municipal infrastructure are made annually by the Government of Canada and the Government of Nova Scotia. The 2014 Economic Action Plan of Canada introduced the New Building Canada Fund, dedicating $426 million in capital funding to Nova Scotia from 2014 to 2023. Significant emphasis has been given to highway development, with top investments including the Sackville-Bedford-Burnside Connector ($86 million), Highway 103 twinning ($66 million), and Highway 101 twinning ($34 million). The Highway 103 project is of direct relevance to new bio-projects in the SW NS BDO Zone, as the highway is the principal arterial road connecting SW NS to HRM. Continued improvements are being made to Hwy 103 under provincial funding. Projects include replacement of the current Highway 102/103 interchange structure, the continued twinning of Hwy 103 in Lunenberg County, as well as general enhancements to existing road layouts (Map G-2). Infrastructure improvement projects are also offered for secondary and tertiary roads; Nova Scotia's Capital Plan 2023-24 indicates a total investment of approximately $100 million for secondary highways and gravel roads. Between 2023 and 2030, the Government of Nova Scotia expects to spend more than $1 billion on road and bridge infrastructure improvements. These investments are of direct benefit to the wood procurement and final product sales of biomass-based projects located in SW Nova Scotia.

**Map G-2. Highway 103 Interchange Planning**




SW Nova Scotia will also benefit from continued federal and private sector investments in general infrastructure improvements. A federal investment of $58 million in 2023/24 will be directed towards critical areas such as environmental sustainability, public transit networks, and water and sewage systems. The Michelin manufacturing facility in Bridgewater, which is the single largest employer in the region, will benefit from approx. $150 million in public-private sector funding for an infrastructure expansion project aimed at enhancing the company's facilities and bolstering the production of electric vehicle tires in Nova Scotia. By leveraging these targeted investments, SW Nova Scotia can further enhance local infrastructure and provide better commercial access for prospective businesses in the region.

### *Healthcare*

The healthcare system in SW Nova Scotia employs an integrated approach, combining primary to tertiary services and harnessing advanced technology like Electronic Health Records and telemedicine for streamlined operations and predictive care. Community engagement and inclusivity form a core pillar of this model, as evidenced by the numerous community health centers and comprehensive mental health programs, which have contributed to a significant 20% improvement in mental health outcomes over the past five years. Alongside a 12% increase in skilled healthcare professionals over the last decade, attributable to a targeted workforce development strategy, the system emphasizes environmental sustainability, leading to a 30% reduction in carbon emissions through energy-efficient facilities. This dedication to continuous growth and improvement is further exemplified by Bridgewater's announcement of a $25 million expansion to its general hospital, underscoring Southern Nova Scotia's ongoing commitment to investing in its healthcare infrastructure.

### *Education & Technical Training*

Nova Scotia benefits significantly from globally recognized universities, colleges, and technical institutes. These institutions, including Acadia University, Dalhousie University, Saint Mary's University, Nova Scotia Community College, and several local technical colleges, provide the region with a steady stream of highly skilled professionals. Located in Wolfville, Acadia University is known for its Business, Computer Science, and Engineering programs, while Saint Mary's

University in Halifax offers strong programs in Commerce, Engineering, and Arts. The Nova Scotia Community College (NSCC), provides vocational training to more than 20,000 students each year. The NSCC campuses in Lunenburg and Shelburne contribute to the technical skill base of the region, producing a workforce ready to meet the demands of various industries.

Forestry workforce development institutions in the Canadian maritime region are advanced relative to other areas of North America. The High Performance Logging (HPL) initiative of the Canadian Woodlands Forum (CWF), BioApplied, New Brunswick Community College (NBCC), and Forest Liaison has been in development since 2011. The objective of the initiative is to increase recruitment and retention of a skilled equipment operator workforce in the Maritimes by working closely with skilled candidates and logging contractors interested in hiring and retaining entry-level machine operators. The model has been proven through successful program deliveries in 2016 and 2022. The NSCC and the Nova Scotia Apprenticeship Agency have also expressed interest in this model of workforce development. Large forest companies in the region – notably Freeman Lumber – also actively work to develop the contractor base through recruitment and training. In recent years, the CWF has also demonstrated a proof-of-concept forestry truck operator program in collaboration with Class 1 licensing in Nova Scotia. With government and industry support, logging and trucking workforce development programs of this kind could significantly increase supply chain capacity within the BDO Zone. These organizations and initiatives are supported at the provincial level by the Nova Scotia Forestry Sector Council, which works to build the forestry workforce in collaboration with the aforementioned training institutions.

### *Public Safety & Emergency Services*

All four sites are subject to environmental risks such as hurricanes, floods, or other severe weather conditions. Additionally, their proximity to populated areas presents potential risks to the local community in the event of accidents or malfunctions. Public safety infrastructure in SW Nova Scotia includes several emergency services, including the North Queens Fire Association in Caledonia and the Chester Volunteer Fire Department in Chester County. The Royal Canadian Mounted Police (RCMP) provide general policing and emergency response services.

### *Telecommunications*

All sites have access to high-speed internet. The telecommunications network in SW Nova Scotia is provided mainly by Bell Canada and Eastlink. The provision of speeds up to 1 Gbps in the region allows for fast and secure data transmission, benefiting various business operations like cloud-based storage and application usage, video conferencing, and real-time data analysis. In close collaboration with the provincial government's Internet for Nova Scotia Initiative, fibre optic and other high-speed internet services continue to expand in SW NS.

### *Utilities*

Electricity transmission and distribution is managed by Emera's Nova Scotia Power (NSP), annually generating, and transmitting over 10,000 gigawatt hours (GWh) of electricity to roughly 520,000 residential, commercial, and industrial customers across the province. Average electricity prices for large-power customers (>5,000 kW) in Nova Scotia over the period 2018 to 2022 are below the national average ($0.11/kWh compared to $0.12/kWh).[28] The province's coal generating fleet is being phased out by 2030 and is expected to be replaced largely by renewable electricity capacity. The current share of renewable electricity in the province's generation portfolio is ~25% and consists of wind (~20%), hydroelectricity (~12%), and biomass (~3%). The share of renewable electricity is expected to reach 40% by 2030. By this time, most renewable electricity consumed in the province is expected to be sourced from the 824 MW Muskrat Falls hydroelectric facility in Labrador, which has experienced technical problems since its completion in 2021. Construction of

[28] Statistics Canada. Table 18-10-0204-01 Electric power selling price index, monthly. https://doi.org/10.25318/1810020401-eng

an undersea high voltage direct-current (HVDC) transmission line connecting Nova Scotia to the facility was completed in 2017. Natural gas distribution infrastructure is not available in SW NS. Other utilities, including water and sewerage, are well-maintained and modernized. Water supply infrastructure in Southern Nova Scotia is efficient and managed by various municipal water services, ensuring a consistent and dependable water supply. Several water treatment facilities that uphold strict water quality standards are present in the region, making the water suitable for domestic, commercial, and industrial usage.

### *Regional Income and Employment*

The average unemployment rate in SW Nova Scotia stands at 10%. The median after-tax income for households in SW Nova Scotia is $53,129 per annum, with 40.2% of the population below $69,999.[29] The individual workforce consists of approximately 65% of full-time workers earning below $60,000 per annum. The average living wage in SW Nova Scotia is $22.55/hour. The largest industries by employment in SW Nova Scotia are forestry, agriculture, fishing, retail trade, healthcare, educational services, and public administration. A breakdown of employment status reveals that 81% of the workforce are employed individuals with a fixed working space, while 12.1% had no fixed working address in the region.

## Site Overviews

### *1. Kaizer Meadow Industrial Park (Municipality of the District of Chester, NS)*

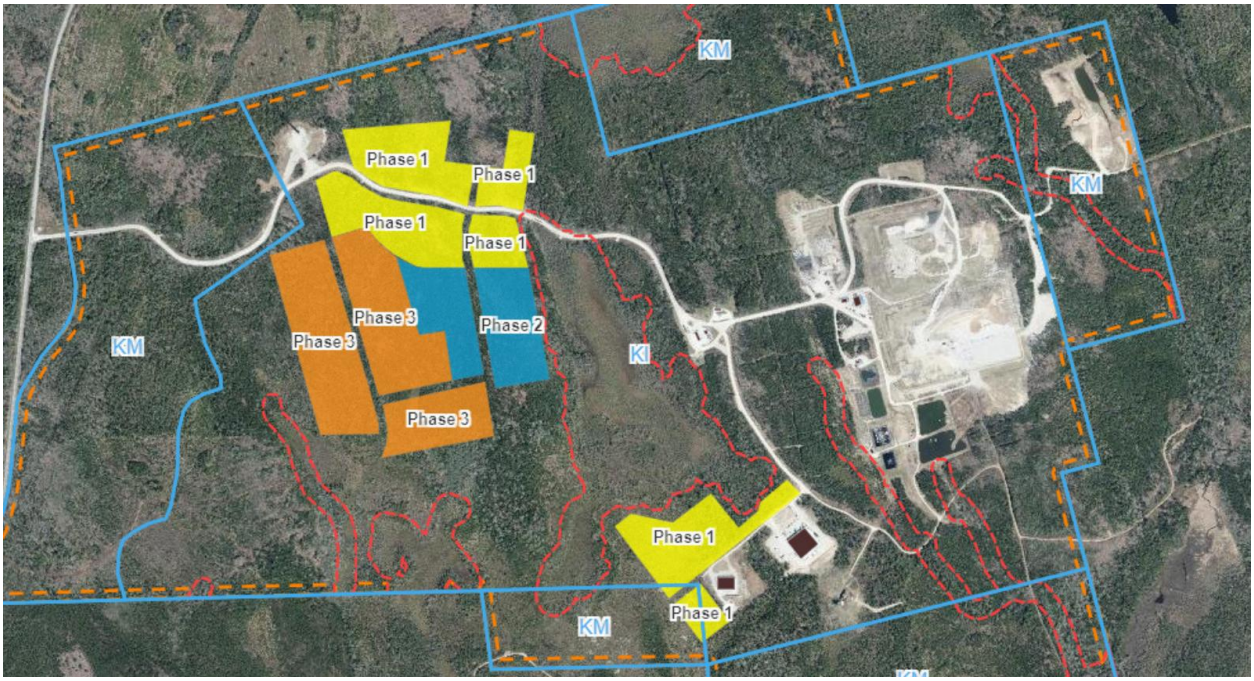
- Flexible Zoning regulations
- Established biofuel manufacturing capacity
- Surplus landfill outputs locally

### *Physical Infrastructure*

Kaizer Meadow Industrial Park is owned by the Municipality of the District of Chester, with several 150-acre lots available for industrial development at $20,000 per acre. The site is strategically located, providing convenient one hour access to the Port of Halifax, Halifax City Centre, and Halifax Stanfield International Airport. The park is zoned for heavy industrial use, including waste-to-energy (landfill gas/biomass) and forestry processing. The availability of three-phase power at land parcels adjacent to the main road makes this site an excellent location for heavy-duty industrial operations. Other on-site energy infrastructure includes propane-based heating equipment and a wind turbine. The site includes a graded, gravel road capable of accommodating industrial transport vehicles as well as weigh scales. Water supply infrastructure includes an onsite well and septic system, an essential infrastructure feature for biomass-based manufacturing facilities.

[29] Ibid.

**Map G-3. Kaizer Meadow Park Overview**




*Logistics*

The location of the industrial park offers excellent access to the workforce, intermodal transportation infrastructure, and commercial markets of the Halifax Regional Municipality (HRM). The site is conveniently located on a public right-of-way, providing easy access to the nearby provincial series highway, enabling efficient transportation and logistics. Average travel time to HRM during high-traffic periods is less than 1.5 hours. The site's proximity to both HRM and the working forests of Lunenberg, Queens, Annapolis, and Kings counties advantages enterprises involved in value-added biomass-based manufacturing and marketing.

**Map G-4. Kaizer Meadow Local Roads and Highways**




### *Social Infrastructure and Workforce*

Kaizer Meadow Industrial Park is located within a one-hour drive distance of HRM and Annapolis Valley, enabling access to a large potential workforce with technical and business development capabilities. The area is also home to a skillset aligned with industrial operations, supported by nearby biotechnology companies. Several organizations involved in the environmental and biomass-based sectors have already established operations within the park, including Sustane Technologies, Full Circle Environmental Solutions, and the Municipality of Chester's solid waste facility and environmental management centre. Property values in the region are approx. $389,000, below the provincial median. Median income is approximately $54,000.

## *2. Bridgewater Business Park (Bridgewater, NS)*

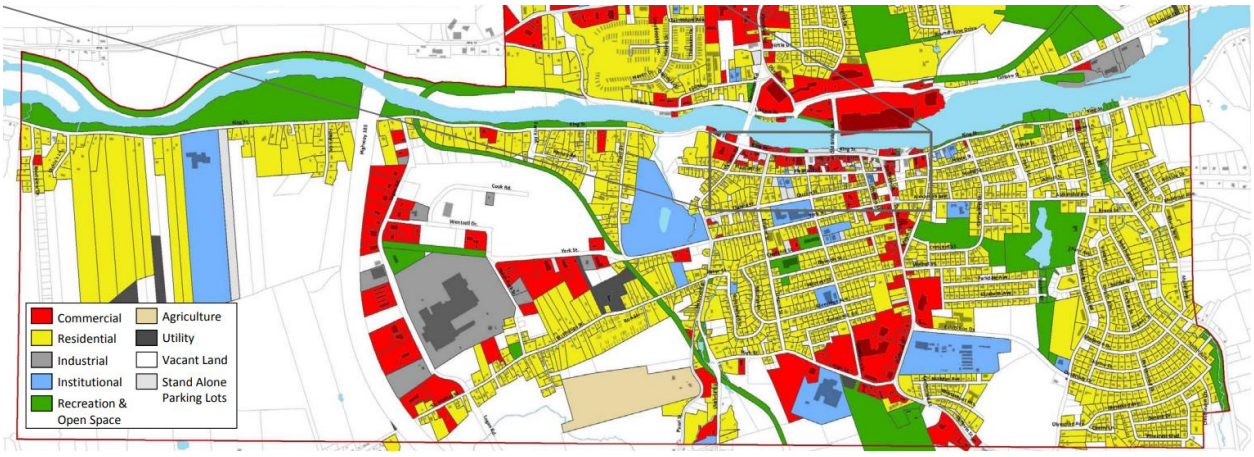
- SW Nova Scotia's largest industrial park
- Cleantech development initiatives
- Proven investment attraction leadership

### *Physical Infrastructure*

Bridgewater Business Park, located in Lunenburg County, is SW Nova Scotia's largest industrial park with over 50 businesses and a workforce exceeding 1,500 individuals. A number of industrial-scale manufacturers are located within the park, the largest of which is a Michelin North America Inc. facility (est. early 1970s) with over 1,200 employees. The

park is also home to several wholesale businesses, government agency offices, and a diverse mix of small and medium-sized enterprises. The park has abundant undeveloped land available with clear municipal support for future expansion for both large and small projects. The park is currently expanding north of Highway 103, with new interchange and connector roads under construction, expected to open for new development by 2025. On-site infrastructure compatible with industrial manufacturing is well-developed within the park, owing largely to the development of the Michelin plant over the last 50 years. The Bridgewater Wastewater Treatment Plant, serving Bridgewater Industrial Park, has a treatment capacity of 5,682 cubic meters per day, ensuring a steady supply of clean water for operational needs. Leveraging the industrial and economic capacity of the park, the Town of Bridgewater has pursued an aggressive renewable energy development strategy ("Energize Bridgewater"). The industrial park's coastal geography provides an ideal environment for wind energy generation. Several wind energy investments are planned for the area, including the 50 MW Nova Wind Energy project. These pending investments, coupled with the town's sustainability drive, make Bridgewater Industrial Park a prime location for businesses looking to tap into the larger renewable energy sector.

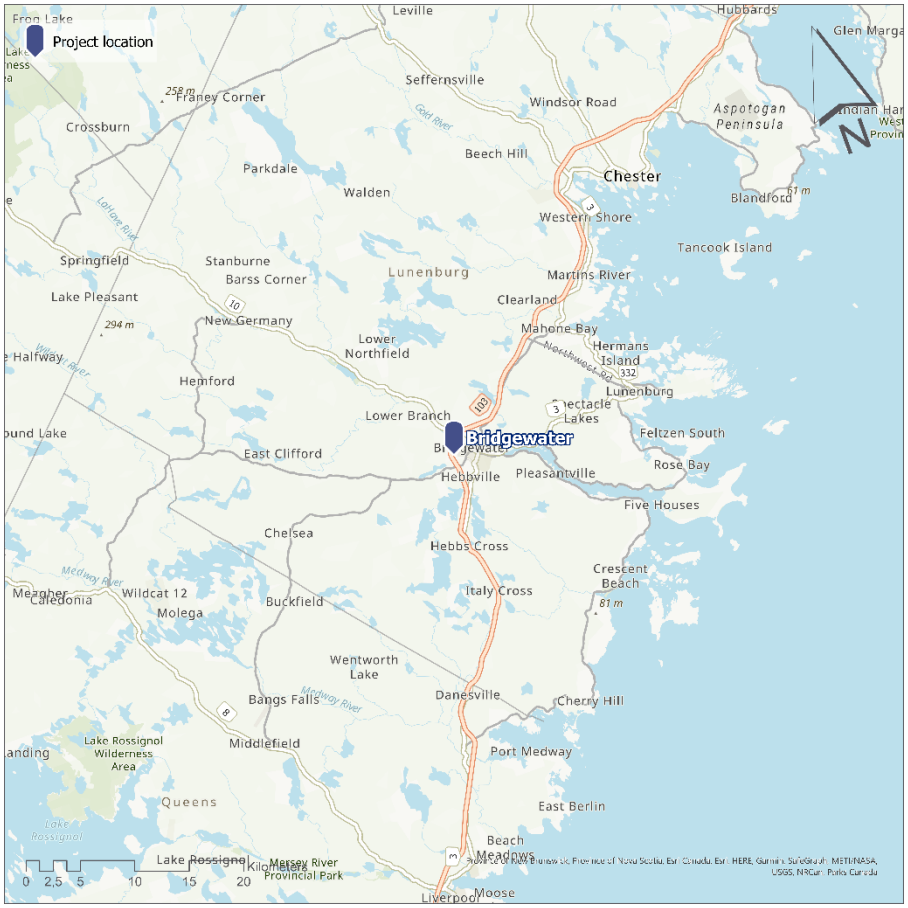
**Map G-5. Bridgewater Historical Land Expansions**




*Logistics*

Regional road infrastructure is also conducive to economic development and biomass-based manufacturing facilities. Highway 103 facilitates a <1.5-hour drive to and from Halifax, thereby facilitating inter-city commercial movement and residential transport/commutes. Easy access to the broader SW NS region is made possible by proximity to Highways 8, 10, and 12. Route 325 and Route 331 further extend the road connectivity, linking the town to the Freeman Lumber sawmill and providing multiple routes for transportation of goods and services. A new interchange is also in development, linking the park to over 120 acres of additional development space.

**Map G-6. Bridgewater Local Roads and Highways**




### *Social Infrastructure and Workforce*

The industrial park has a diverse and skilled labour market, influenced by continued business creation and capacity expansions. The total population within a 30-minute travel time exceeds 60,000 residents, providing businesses with access to a significant workforce and local customer base. Bridgewater's property market is compatible with a range of preferences and income levels, enhancing the appeal for potential workers with an average house price of $397,500 (2022). The median income for full-time employed individuals in the Town of Bridgewater is approximately $53,000.

## *3. Freeman Lumber (Greenfield, NS)*

- Significant biomass procurement advantages
- Surplus adjacent land parcels available
- Flexible heavy industrial zoning

### *Physical Infrastructure*

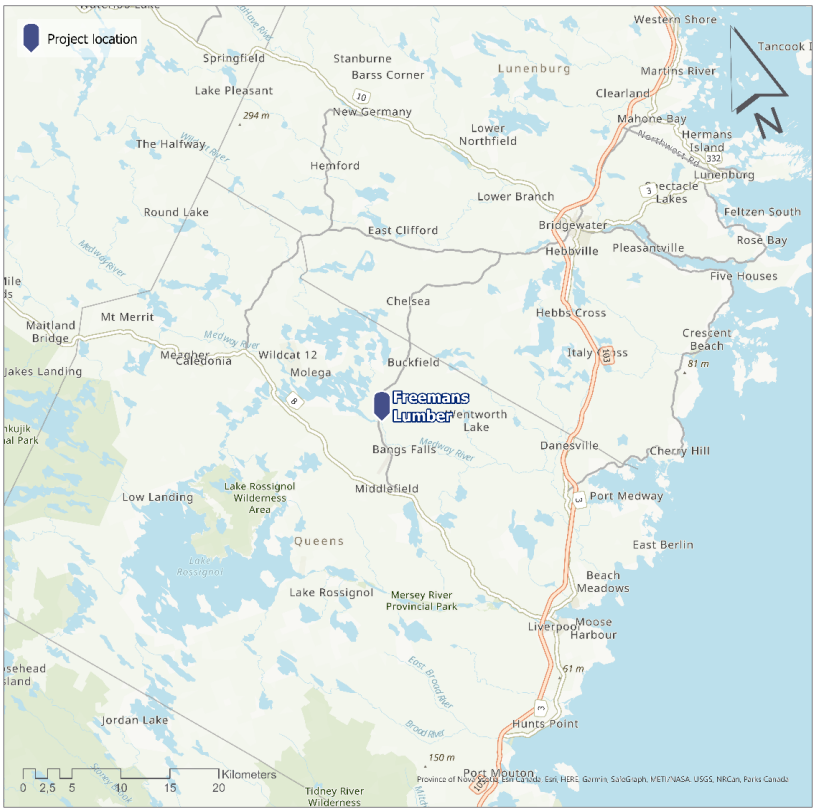
Freeman Lumber is a fully optimized lumber manufacturing facility located in Greenfield, Queens County, with a capacity of 135 million board feet (MMBF) per year and a recent production level of ~110 MMBF per year. The site has significant wood fibre procurement advantages due to its large annual throughput of sawlogs (~500,000 GMT/yr), generating over 85% of the sawmill residuals produced within the BDO Zone annually (~250,000 GMT/yr). The mill is located in proximity to the private and public working forests of the region. The site features newly cleared lands specifically zoned for heavy

industrial development and construction. Site infrastructure includes three-phase power, an on-site well and septic system, and a siltation system that can accommodate additional capacity. Biomass handling and receiving infrastructure, including loaders and weigh scales, are also available. The facility uses a fraction of its annual residuals production for internal process heat requirements.

**Map G-7. Freeman Lumber Facility (Greenfield)**



**Map G-8. Freeman Lumber Local Roads and Highways**




### *Logistics*

Freeman Lumber is located in close proximity to actively managed private and public forests, including larger tracts managed by WestFor and private companies. All primary and secondary roads in proximity to the site have maximum weight designations and are frequently trafficked by B-train configurations for roundwood and residuals shipping and receiving. An additional secondary road is being constructed to provide easier entry to the newly cleared section of the site. This improves the site's overall accessibility and further facilitates the efficient transportation of goods and materials flowing from the prospective site.

### *Social Infrastructure and Workforce*

Freeman Lumber is the largest employer in Queen's County and has a proven track record for hiring, procurement, and logistics. The sawmill has well-established relationships with its workforce of over 180 journeymen, contractors, and business development specialists and with the region's forest processing facilities and broader logging contractor base. The mill also has an established project management network, including for project construction, operations, and logistics that prospective bio-projects can draw upon.

## *4. Port Mersey Commercial Park (Brooklyn, NS)*

- Major land parcels for development
- Marine access (60m wharf)
- Access to local cogeneration (excess steam, natural gas, diesel and electric)

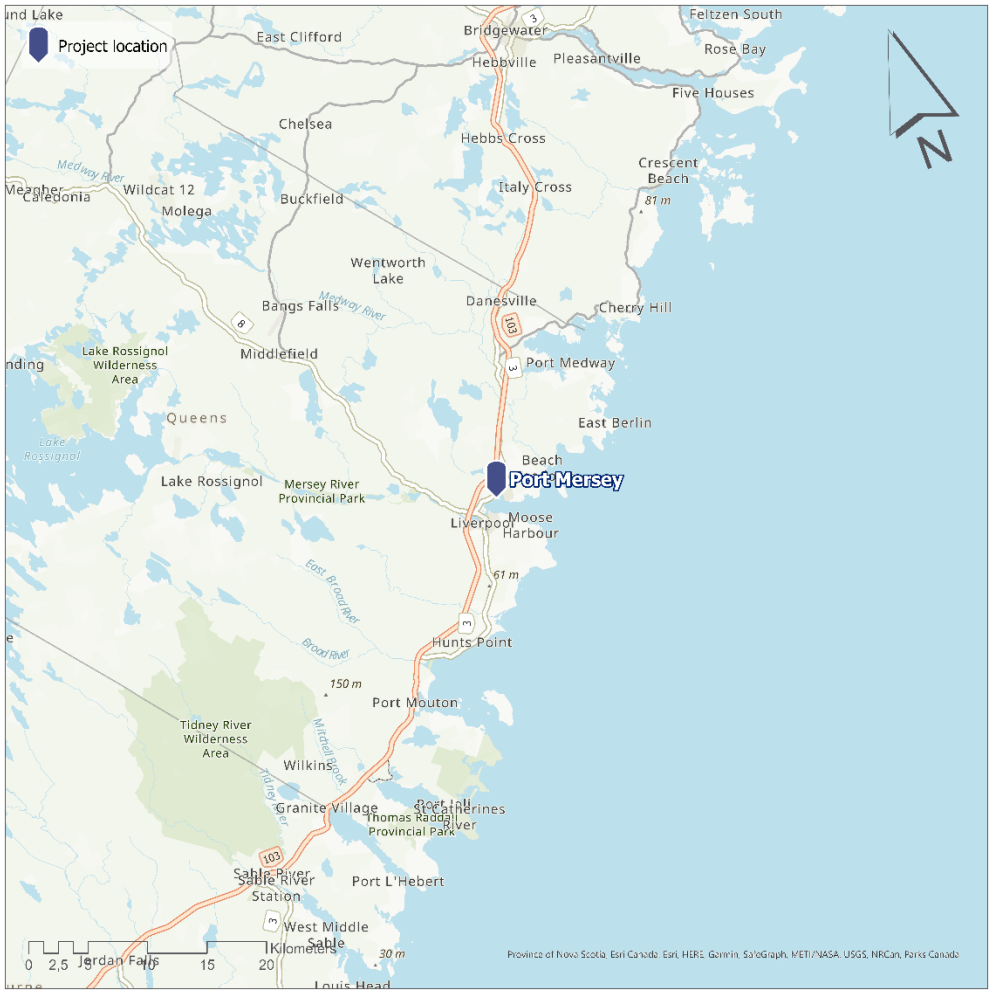
*Physical Infrastructure*

Port Mersey Commercial Park is a 60-acre site in Queens County. The site was formerly occupied by the Bowater Mersey Paper Company Limited, which procured approx. 350,000 GMT/yr of low grade roundwood for purposes of pulp production up until its closure in 2012. The site retains features that were necessary for the success of the former manufacturing facility, including a 550-foot active wharf, a robust local power grid with capacity for interconnection with an adjacent biomass-based power producer (Brooklyn Power), and significant industrial water supply. The park is owned by the Province of Nova Scotia and is zoned for medium-sized industrial activities. The site also benefits from adjacent provincially-owned land that is eligible for industrial development. The space offers flexible options for a variety of development plans, accommodating both large and small-scale biomass-based projects. The location has already undergone Phase 1 and 2 environmental site assessments. The existing manufacturing and processing facilities onsite have the potential to contribute surplus inputs (i.e., forestry and animal feed byproducts), enabling synergistic business relations and efficiencies. Three-phase power, high-pressure steam, and diesel and natural gas fueling receivers are all available on site. The site also includes a 190-meter-long wharf that can accommodate smaller commercial vessels no longer than 20 meters in length. An offsite treatment facility is available to handle waste and byproducts, which provides lower operational expenses for prospective businesses to the site.

*Logistics*

The park provides direct access to Highway No.3 and has a park-owned highway that connects to the nearby 100 Series highway. Port Mersey's proximity to key transport routes is pivotal for the industrial area's success. Paved public access roads accommodate industrial transport vehicles. The site's flat and predominantly paved topology simplifies construction and transportation processes for developers.

**Map G-9. Port Mersey Local Roads and Highways**




## *Social Infrastructure and Workforce*

The industrial hub of Port Mersey has an established technical workforce and is within a 35-minute drive of the Town of Bridgewater. The Brooklyn Power facility and a couple biotechnology companies have contributed to the development of a local workforce familiar with bioproduct marketing and biomass supply chain management. Housing trends in the region are reflective of wider Nova Scotia trends, with the 2023 data indicating a steady increase in property values. The average price of a house in Queens County is about CAD $290,900 providing affordable housing options for the region, and relocation incentives for workforce settlement. The region has a median household income of $71,500.

# APPENDIX H: LEGAL DISCLAIMER

This BDO Zone Rating (the "Rating") is prepared for, and provided to, Greenspring Bioinnovation Hub, and is intended to be read and used in its entirety and not in parts. Separation or alteration of any section or page from the main body of this Rating is expressly forbidden. In preparing this Rating, Ecostrat has used information obtained from third parties or otherwise publicly available. All such information has not been independently validated, verified, or confirmed by Ecostrat (except where otherwise specifically indicated) and Ecostrat makes no representation or warranty as to the accuracy or completeness of any information provided by third parties or otherwise publicly available.

Neither Ecostrat nor the members of the BDO Zone Advisory Committee make any representation or warranty as to the accuracy or completeness of the information and content in this Rating and shall have and accept no liability for any statements, opinions, information or matters (expressed or implied) arising out of, contained in or derived from this Rating or any omissions from this Rating, or any other written or oral communication transmitted or made available to any other party in relation to the subject matter of this Rating. Any use which a third party makes of this Rating, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Decisions made, or actions taken based on or resulting from Ecostrat's work product shall be the responsibility of the parties directly involved in those decisions or actions. There are no third-party beneficiaries with respect to this Rating, and Ecostrat expressly disclaims any liability whatsoever (whether in contract, tort or otherwise) to any third party. Ecostrat makes no representation or warranty (express or implied) to any third party in relation to this Rating. A decision by any entity to disclose this Rating to the public or privately to a limited number of potential institutional accredited investors or other qualified investors shall not constitute any permission, waiver, or consent from Ecostrat for any third party to rely on this Rating except for informational purposes, and as such, is provided on such basis. Access to this Rating and its use by any third party implies acceptance by the third party of the terms and conditions contained in this section and other parts of this Rating.

All information included is based on information available on the date hereof and neither Ecostrat nor the members of the BDO Zone Advisory Committee are under any obligation to update the information herein. No investor, security holder, or other person should rely on the content of this report in any way in connection with the purchase or sale of any security.