ASHTABULA, OHIO

Biofuel Development Opportunity Zone

RATING GRADE: 'BB'

Date of Issue: May 8, 2025

BB

Rating Parameters:

Category	Rated Quantity	Delivered Price	Supply Zone Size
Miscanthus	**24,750 bdt/yr**	**$135-$175/bdt**	**75-mi drive distance from Ashtabula, OH**

BDO ZONE ASSETS

- Regional miscanthus cultivation and harvesting experience.
- Majority of established miscanthus cropland located within 30 miles of Ashtabula.
- Absence of competitors for miscanthus in the Competition Zone.
- Well-developed infrastructure with rail spur, port access, and competitive electricity costs

BDO ZONE LIABILITIES

- New developer will need to negotiate leasing and contract terms with landowners.
- Aspects of miscanthus agronomy remain uncertain, including longevity and optimal fertilization regime.
- Additional harvesting equipment required.
- Subsidies may be required to establish additional cropland.
- Sustained year-to-year production of the rated quantity is unproven.

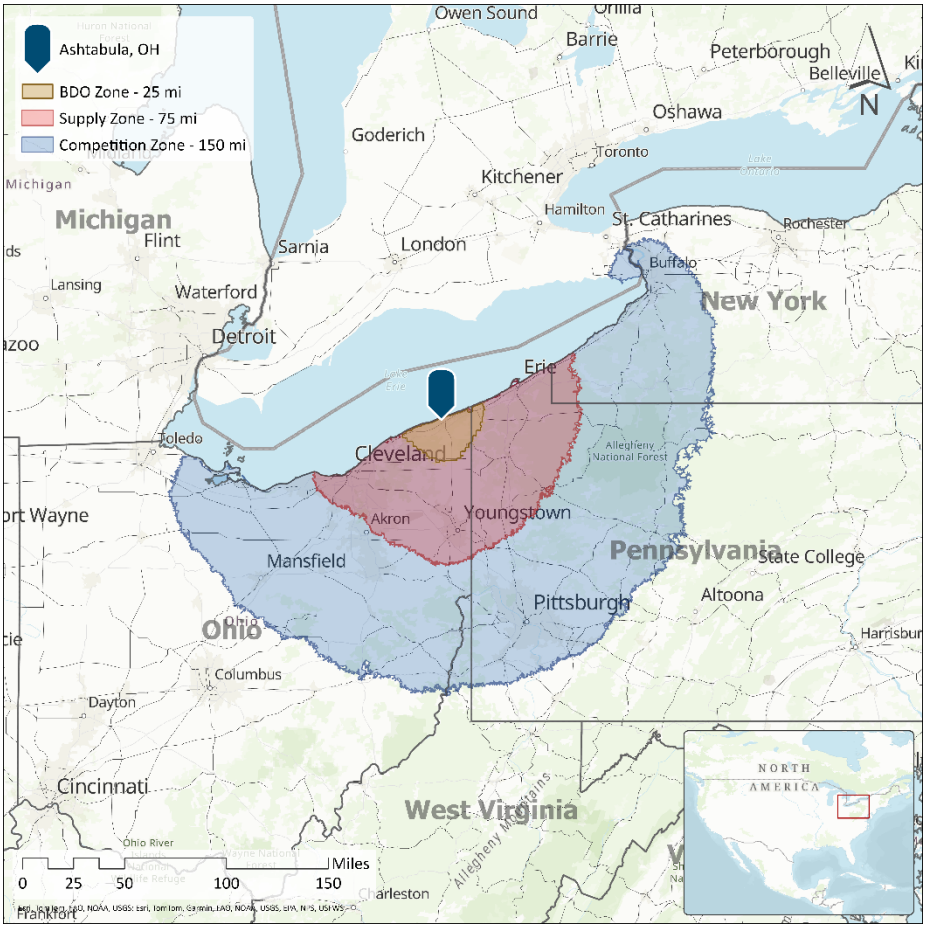
RATING GRADE

The Ashtabula, OH, Biofuel Development Opportunity Zone, is rated 'BB', or 'moderate' risk.

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

'BB' ratings indicate moderate prospects for Feedstock Supply and Infrastructure (FS&I) with an elevated vulnerability to risk over time. Accessing the full rated quantity will require that project proponents work with landowners to establish additional miscanthus cropland.

ASHTABULA COUNTY, OH BDO ZONE



ANALYST NOTES

The Ashtabula, OH BDO Zone is centered in the city of Ashtabula, encompassing a 7,000-square mile area in northeast Ohio and northwest Pennsylvania. Giant miscanthus (hereafter, "miscanthus") is a woody perennial plant that is capable of yielding biomass suitable for the production of bioproducts or bioenergy on an annual basis. The region previously supported a miscanthus-based bioproduct manufacturing facility from 2011 to 2019, operating by Aloterra. During this period, approximately 5,000 acres of miscanthus cropland was established under the USDA's Biomass Crop Assistance Program (BCAP). Since the facility closed in 2019, approximately half of the established cropland has been converted to other uses.

The supply analysis considers the entire 2,500 acres of miscanthus cropland already established, as well as a portion of the 12,500 acres of economically marginal land estimated to be present within the Supply Zone. The supply scenario assumes that a project developer would establish additional miscanthus cropland through leasing agreements with landowners, as was the case under the previous project.

A total of 24,750 bdt/yr of miscanthus is rated as potentially available for new project developers at moderate risk. Consistent procurement of the rated quantity would require the establishment of an additional 3,000 acres of miscanthus cropland over a scale-up period of six years in addition to the existing 2,500 acres of miscanthus cropland. The rated quantity represents about one-third of the total amount of miscanthus that would be produced if all economically marginal lands in the Supply Zone were converted to miscanthus. It is estimated that the rated quantity of miscanthus could be harvested, processed, and delivered to a facility located in the vicinity of Ashtabula for a price between $135/bdt and $175/bdt. A description of the methods used to estimate the rated quantities and prices is presented in Section B.

BDO ZONE ASSETS

Miscanthus cropland has been cultivated in the region since 2011. Expertise and knowledge developed under a previous miscanthus supply chain in the region remain available for new project proponents. Supply chain inefficiencies resulting from inclement weather, lack of harmonization between chopping, storage, and trucking supply phases, and other factors are therefore likely to be resolved over time.

All risk indicators related to transportation, including feedstock transportation costs, diesel cost impacts, and ownership of transportation equipment, were scored as low or medium risk. This is due to the relatively short distances over which feedstock transportation is likely to occur to support new bio-projects located in Ashtabula. Most established miscanthus cropland is located within a 30-mile drive distance of Ashtabula. A new developer is expected to prioritize miscanthus crop establishment on economically marginal lands in close proximity to Ashtabula. Trucking rates are also relatively low compared to other areas of the USA, ranging from $120 to $150 per hour.

There are no significant competitors for miscanthus in the Competition Zone. The only competitor has procured a maximum of 700 tons/yr in recent years and there are plans to phase out operations. A new bio-project developer would therefore have access to the entire rated quantity with no risk of competition.

BDO ZONE LIABILITIES

Land ownership structure presents a substantial liability to supply chain development in the Ashtabula BDO Zone. All current and prospective miscanthus cropland is privately owned, with parcel sizes ranging from 10 to 60 acres. The most likely project development scenario would involve developers leasing land from private landowners, as farmers in the region have a preference for staple crops (e.g., corn and soybeans). Developers will need to negotiate new contracts with existing landowners as well as attract new landowners to lease their land for miscanthus cultivation. Establishing new leasing contract terms with landowners could be challenging due to the closure of the previous project.

Establishing new leasing agreements could prove particularly challenging due to negative experiences associated with the previous project. Following Aloterra's closure in 2019, landowners lost their annual lease payments, no longer qualified for Current Agricultural Use Valuation (CAUV) tax subsidies, and had to absorb the

costs of removing miscanthus rhizomes themselves. This experience has created skepticism regarding the economic viability of miscanthus cultivation and wariness toward new development proposals. New contracts would likely require higher lease payments and more favorable terms to overcome this resistance.

Financial considerations create additional barriers to supply chain development. Miscanthus crop establishment costs are relatively high, potentially reaching $1,000 per acre when accounting for site preparation, rhizome purchase, and planting operations. Government subsidies may be required to maintain delivered biomass costs near the minimum of the rated price range ($135/bdt). Without government subsidies to support further crop establishment, the annualized delivered cost of miscanthus biomass would approach the maximum of the rated price range ($175/bdt), potentially limiting economic viability for certain applications.

Technical and agronomic factors introduce additional risk elements. Miscanthus remains in an early stage of research, development, and demonstration as a commercial feedstock. Aspects of miscanthus agronomy remain uncertain, including optimal fertilization regimes, long-term crop performance, and stand longevity. These uncertainties create risk that biomass yields may not be sustained over a 20-year project horizon. Additionally, securing adequate harvesting equipment presents a challenge, as the previous supply chain relied on a contractor from New York State with specialized heavy-duty chopping equipment. While modifying conventional corn silage choppers represents a potential alternative, this approach remains unproven at commercial scale. Chopping efficiency may be significantly reduced when working in areas with small or widely dispersed plots, and adverse weather conditions could further impact operations.

INFRASTRUCTURE PROFILE

The 80-acre industrial site in Ashtabula, Ohio offers favorable development conditions for biofuel operations. This former Union Carbide rail yard extends to within 600 feet of Lake Erie and is well-prepared with industrial zoning and all necessary environmental permits. The property has completed environmental assessments showing no contamination concerns, providing strong assurance of regulatory compliance.

Ashtabula, OH, offers a well-developed infrastructure that supports industrial growth, with several advantages for prospective businesses. The region benefits from low electricity costs, making energy-intensive operations more affordable. A rail spur is already in place at the highlighted parcel. Additionally, the area has immediate access to water freight, with port facilities located just over a mile from key industrial sites. Nearby airports in Erie, PA, and Cleveland, OH, provide air transport options for business travel and cargo needs.

However, there are challenges to consider, including higher-than-average natural gas costs, which could impact industries reliant on this energy source. Additionally, the local workforce is aging, which may present long-term labor availability concerns for businesses requiring a younger or highly specialized talent pool.

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SCORING & RATING METHODOLOGY

In assessing the biomass supply chain risk for the Biofuel Development Opportunity (BDO) Zone, 88 Risk Indicators from the US 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.

- The BDO Zone is a 25-mile drive distance from the center point, which represents the siting area for future biomass projects and is where the industrial site is located.
- The Supply Zone is a 75-mile drive distance from the center point, where feedstock availability was assessed.
- The Competition Zone is a 150-mile drive from the center point, where consumers can compete for feedstock generated in the Supply Zone.

Feedstock quantities are expressed in bone dry tons per year (bdt/yr), while feedstock costs are expressed in USD ($). Maximum transport distance is based on a 75-mile driving distance from the center point (Ashtabula, OH).

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

Each BDO Zone Risk Indicator is given a **Raw Risk Impact (RRI)** score, which denotes the impact on a future BDO Zone project due to the Risk Indicator. RRI scores are scaled as either very low (2), low (4), medium (6), high (8), or very high (10). Impact level scores are based on the impact level of a risk on the successful development and deployment of a BDO Zone project with no mitigation measures.

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

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

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

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

The total risk rating for the BDO Zone is the average of all Loaded RI scores and Infrastructure Indicators. The BDO Zone score for Ashtabula County, OH is ***23.65 out of 100, resulting in a 'BB' designation.***

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



SECTION A: RISK INDICATOR SUMMARY

Figure A-1. All Risk Indicators Sorted by Risk Level

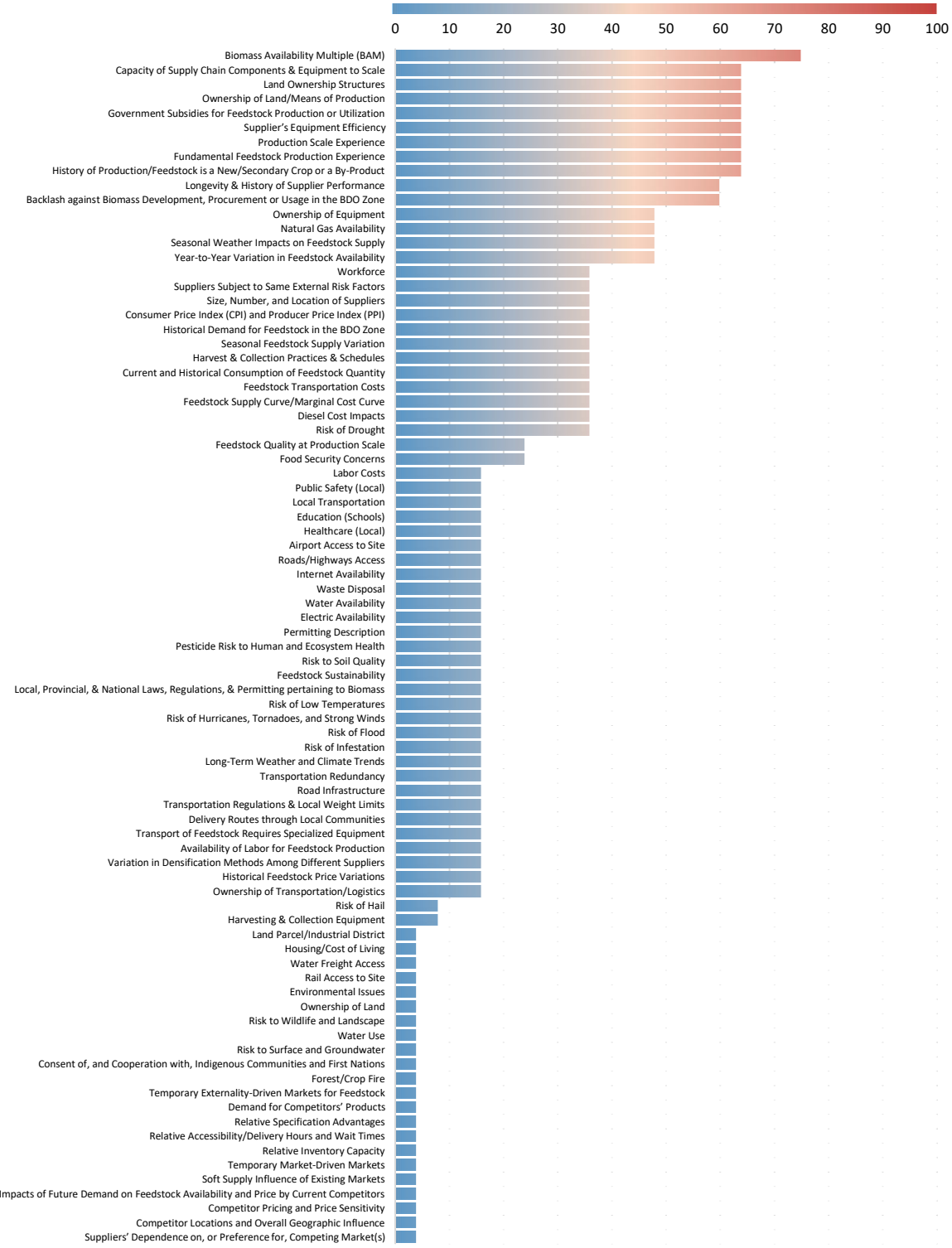


Table A-1. Risk Indicators and Associated Scores

Feedstock Supply Chain Risk Indicators	Raw Risk Likelihood	Raw Risk Impact	Gross Risk Indicator	Mitigation /Notching	Loaded RI Score
Category 1.0: Supplier Risk					
1.1 Risk Factor: Credit-Worthiness/Future Solvency of Suppliers					
1.1.1 Longevity & History of Supplier Performance	10	8	80	25%	60
1.2 Risk Factor: Conflicts of Interest/Vested Interest with Competing Market(s)					
1.2.1 Suppliers' Dependence on, or Preference for, Competing Market(s)	2	2	4	NN	4
1.3 Risk Factor: Supplier Control Over Production and Transportation					
1.3.1 Ownership of Land/Means of Production	8	8	64	NN	64
1.3.2 Ownership of Equipment	6	8	48	NN	48
1.3.3 Ownership of Transportation/Logistics	4	4	16	NN	16
1.3.4 Feedstock as a Secondary Transformation	NR	NR	NR	NN	NR
1.4 Risk Factor: Supplier Experience					
1.4.1 Fundamental Feedstock Production Experience	8	8	64	NN	64
1.4.2 Production Scale Experience	8	8	64	NN	64
1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity					
1.5.1 Supplier's Equipment Efficiency	8	8	64	NN	64
1.6 Risk Factor: Supplier Motivation					
1.6.1 Feedstock Production Priority	NR	NR	NR	NR	NR
Category 2.0: Competitor Risk					
2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets					
2.1.1 Competitor Locations and Overall Geographic Influence	2	2	4	NN	4
2.1.2 Current and Historical Consumption of Feedstock Quantity	6	6	36	NN	36
2.1.3 Competitor Pricing and Price Sensitivity	2	2	4	NN	4
2.1.4 Impacts of Future Demand on Feedstock Availability and Price by Current Competitors	2	2	4	NN	4
2.1.5 Soft Supply Influence of Existing Markets	2	2	4	NN	4
2.1.6 Temporary Market-Driven Markets	2	2	4	NN	4
2.2 Risk Factor: Specific Competitors' Competitive Advantage					
2.2.1 Relative Inventory Capacity	2	2	4	NN	4
2.2.2 Relative Accessibility/Delivery Hours and Wait Times	2	2	4	NN	4
2.2.3 Relative Specification Advantages	2	2	4	NN	4
2.2.4 Demand for Competitors' Products	2	2	4	NN	4
Category 3.0: Supply Chain Risk					
3.1 Risk Factor: Feedstock Availability					
3.1.1 Biomass Availability Multiple (BAM)	10	10	100	25%	75
3.1.2 Feedstock Supply Curve/Marginal Cost Curve	6	6	36	NN	16
3.1.3 Seasonal Feedstock Supply Variation	6	6	36	NN	36
3.1.4 Year-to-Year Variation in Feedstock Availability	6	8	48	NN	48
3.2 Risk Factor: Historical Issues					
3.2.1 Historical Feedstock Price Variations	4	4	16	NN	16
3.2.2 Historical Demand for Feedstock in the BDO Zone	6	6	36	NN	36
3.2.3 History of Production/Feedstock is a New/Secondary Crop or a By-Product	8	8	64	NN	64
3.3 Risk Factor: Non-Weather Based Externalities					
3.3.1 Consumer Price Index (CPI) and Producer Price Index (PPI)	6	6	36	NN	36
3.3.2 Currency Risk	NR	NR	NR	NR	NR
3.3.3 Border Risk	NR	NR	NR	NR	NR
3.3.4 Temporary Externality-Driven Markets for Feedstock	2	2	4	NN	4
3.4 Risk Factor: Risks Related to Feedstock Production, Harvest, and Collection					
3.4.1 Harvest & Collection Practices & Schedules	6	6	36	NN	36
3.4.2 Harvesting & Collection Equipment	4	2	8	NN	8
3.4.3 Variation in Densification Methods Among Different Suppliers	4	4	16	NN	16
3.4.4 Availability of Labor for Feedstock Production	4	4	16	NN	16
3.5 Risk Factor: Transportation					
3.5.1 Feedstock Transportation Costs	6	6	36	NN	36
3.5.2 Diesel Cost Impacts	6	6	36	NN	36
3.5.3 Transport of Feedstock Requires Specialized Equipment	4	4	16	NN	16
3.5.4 Delivery Routes through Local Communities	4	4	16	NN	16
3.5.5 Transportation Regulations & Local Weight Limits	4	4	16	NN	16
3.5.6 Road Infrastructure	4	4	16	NN	16
3.5.7 Transportation Redundancy	4	4	16	NN	16

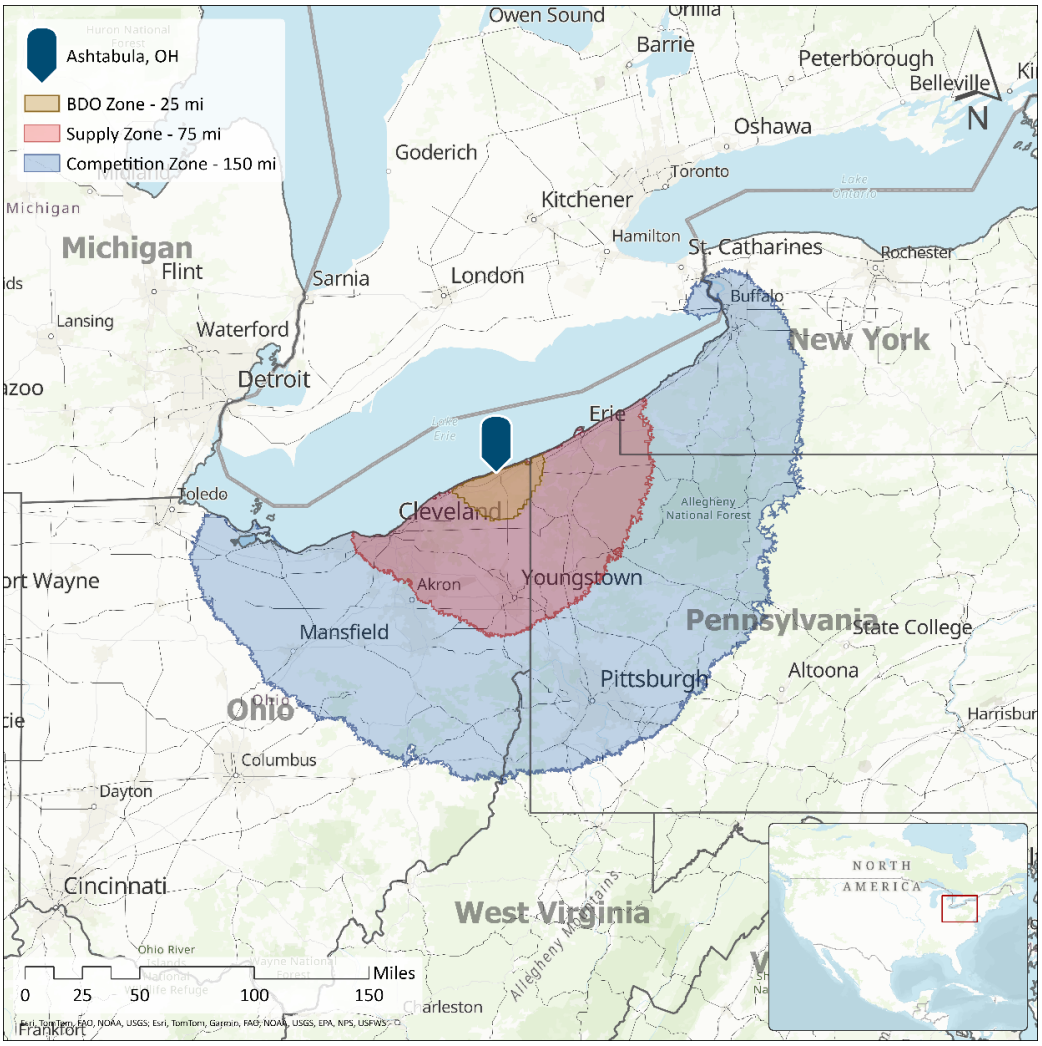
3.6 Risk Factor: Supply Chain Resiliency					
3.6.1 Size, Number, and Location of Suppliers	6	6	36	NN	36
3.6.2 Suppliers Subject to Same External Risk Factors	6	6	36	NN	36
3.6.3 Land Ownership Structures	8	8	64	NN	64
3.7 Risk Factor: Climate and Natural Risks					
3.7.1 Seasonal Weather Impacts on Feedstock Supply	8	6	48	NN	48
3.7.2 Long-Term Weather and Climate Trends	4	4	16	NN	16
3.7.3 Forest/Crop Fire	2	2	4	NN	4
3.7.4 Risk of Infestation	4	4	16	NN	16
3.7.5 Risk of Hail	2	4	8	NN	8
3.7.6 Risk of Flood	4	4	16	NN	16
3.7.7 Risk of Drought	6	6	36	NN	36
3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds	4	4	16	NN	16
3.7.9 Risk of Low Temperatures	4	4	16	NN	16
3.8 Risk Factor: Political and Social					
3.8.1 Government Subsidies for Feedstock Production or Utilization	8	8	64	NN	64
3.8.2 Local, Provincial, & National Laws, Regulations, & Permitting pertaining to Biomass	4	4	16	NN	16
3.8.3 Backlash against Biomass Development, Procurement or Usage in the BDO Zone	10	8	80	25%	60
3.8.4 Consent of, and Cooperation with, Indigenous Communities and First Nations	2	2	4	NN	4
3.8.5 Food Security Concerns	6	4	24	NN	24
3.9 Risk Factor: Sustainability and Environmental Concern					
3.9.1 Feedstock Sustainability	4	4	16	NN	16
3.9.2 Risk to Soil Quality	4	4	16	NN	16
3.9.3 Risk to Surface and Groundwater	2	2	4	NN	4
3.9.4 Water Use	2	2	4	NN	4
3.9.5 Pesticide Risk to Human and Ecosystem Health	4	4	16	NN	16
3.9.6 Risk to Wildlife and Landscape	2	2	4	NN	4
3.9.7 Biomass Classified as Genetically Modified Organism (GMO)	NR	NR	NR	NR	NR
Category 4.0: Feedstock Scale-up Risk					
4.1 Risk Factor: Feedstock Scale-Up					
4.1.1 Feedstock Quality at Production Scale	4	6	24	NN	24
4.1.2 Capacity of Supply Chain Components & Equipment to Scale	8	8	64	NN	64
Category 5.0: Infrastructure					
5.1 Risk Factor: Physical Infrastructure					
5.1.1 Land Parcel/Industrial District	2	2	4	NN	4
5.1.2 Ownership of Land	2	2	4	NN	4
5.1.3 Permitting Description	4	4	16	NN	16
5.1.4 Environmental Issues	2	2	4	NN	4
5.2 Risk Factor: Utilities					
5.2.1 Natural Gas Availability	8	6	48	NN	48
5.2.2 Electric Availability	4	4	16	NN	16
5.2.3 Water Availability	4	4	16	NN	16
5.2.4 Waste Disposal	4	4	16	NN	16
5.2.5 Internet Availability	4	4	16	NN	16
5.3 Risk Factor: Transportation/Logistics					
5.3.1 Roads/Highways Access	4	4	16	NN	16
5.3.2 Rail Access to Site	2	2	4	NN	4
5.3.3 Airport Access to Site	4	4	16	NN	16
5.3.4 Water Freight Access	2	2	4	NN	4
5.4 Risk Factor: Social Infrastructure					
5.4.1 Healthcare (Local)	4	4	16	NN	16
5.4.2 Education (Schools)	4	4	16	NN	16
5.4.3 Local Transportation	4	4	16	NN	16
5.4.4 Public Safety (Local)	4	4	16	NN	16
5.4.5 Housing/Cost of Living	2	2	4	NN	4
5.5 Risk Factor: Labor					
5.5.1 Workforce	6	6	36	NN	36
5.5.2 Labor Costs	4	4	16	NN	16
				Average	**23.65**

SECTION B: BIOMASS AVAILABILITY AND PRICING

OVERVIEW

BDO Zone Risk Indicators are scored with reference to specific feedstock quantities and prices, delivered to a bio-project located within the BDO Zone, defined by a 25-mile drive distance of Ashtabula, OH. The rated quantities are determined by first estimating the potential amount of biomass feedstock that can be produced within the Supply Zone, defined by a 75-mile drive distance from Ashtabula, OH (Map B-1). Biomass availability for new bio-projects is then estimated by subtracting the current demand for the rated feedstock types in the Competition Zone (150-mile drive distance from Ashtabula, OH) from the estimate of total potential production. The rated quantity is then determined by dividing the availability estimate by a Biomass Availability Multiple (BAM) of between 1.5 and 4.0. The BAM is applied to account for uncertainty in underlying data, models, assumptions, and future operating conditions. The resulting rated feedstock quantities are conservative estimates of availability for new projects. The price range associated with each rated quantity is determined through outreach and market analysis in the Competition Zone and reflects the anticipated price that a new bio-project would have to pay to secure the rated quantity of biomass.

Map B-1. Study Area Showing BDO Zone, Supply Zone, and Competition Zone



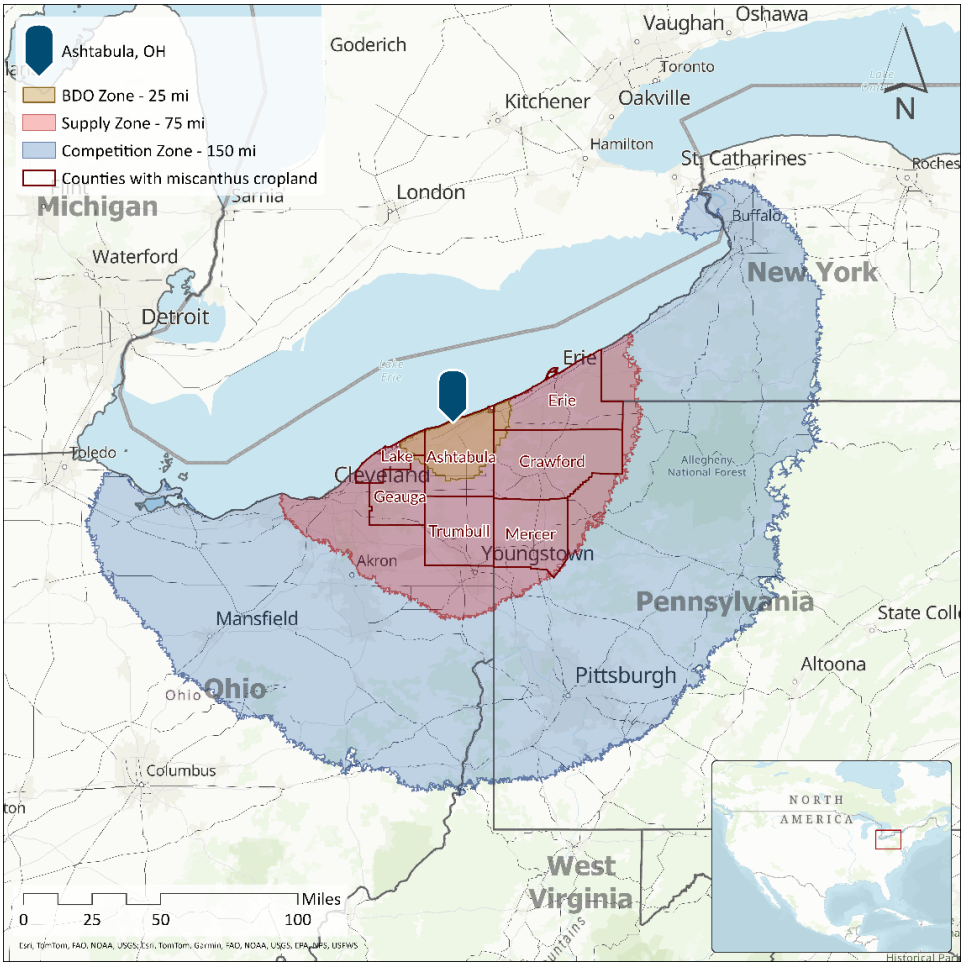
EVALUATED FEEDSTOCKS

Miscanthus x giganteus: A woody perennial grass and sterile hybrid derived from the crossing of *Miscanthus sinensis* and *Miscanthus sacchariflorus*, both native to Asia (hereafter referred to as "miscanthus"). Experience with miscanthus cultivation in northeast Ohio and northwest Pennsylvania indicates that annual harvesting through chopping to particle lengths of between two to three inches can yield 4.5 bdt/acre.[1]

SUPPLY ANALYSIS

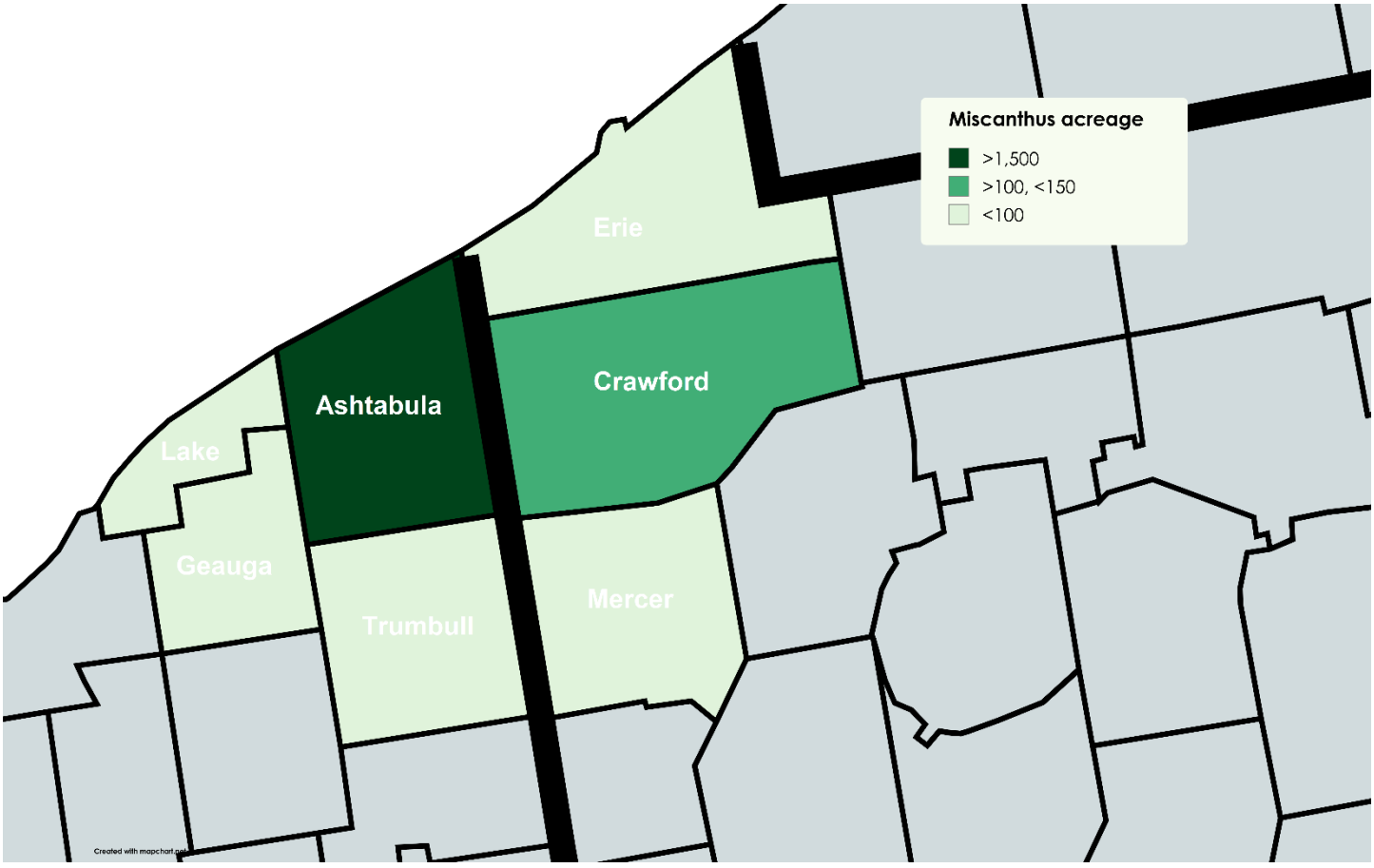
As of May 2025, there are approximately 2,500 acres of miscanthus cropland present within the BDO Zone, distributed in seven counties in NE Ohio and NW Pennsylvania (Map B-2).[2] The majority of this cropland is located in Ashtabula County, with the remaining cropland distributed in six neighboring counties (Map B-3). Miscanthus acreage in the identified counties reached a peak of 4,500 – 5,000 acres in 2017 under a previous project funded by the USDA's Biomass Crop Assistance Program (BCAP). However, the primary purchaser of miscanthus (Aloterra) ceased operations in 2019. Since this time, about half of the planted acreage of miscanthus has been converted to other land uses due to the absence of regional demand.

Map B-2. Location of Counties with Planted Miscanthus Cropland in Relation to the BDO Zone



[1] Based on regional experience in miscanthus agronomy and production.
[2] USDA Farm Service Agency (FSA) – Ohio

Map B-3. Concentration of Miscanthus Cropland by County in the Ashtabula, OH BDO Zone



If analysis is restricted to the existing miscanthus cropland, the maximum potential annual production of miscanthus biomass for new bio-projects would amount to 11,250 bdt/yr, assuming a yield of 4.5 bdt/acre.[3] This is near the maximum annual harvest achieved in support of the previous project. In practice, only a fraction of this maximum potential would be harvested annually due to constraints related to agronomic, meteorological, and logistical factors.

A developer seeking to utilize a larger quantity of biomass would have to establish additional miscanthus cropland through rhizome planting operations. This rating evaluates a scenario where a proponent utilizes existing planted acreage while establishing additional miscanthus on marginal lands over a six-year period. This scenario assumes a proponent with executed contracts for miscanthus-based products could develop new leasing agreements with landowners in the region.[4]

To estimate potential for additional miscanthus cultivation, the analysis utilized a dataset on economically marginal land for energy crops in the contiguous United States.[5] Economically marginal land is defined in the dataset as land that underwent land use change between crop and non-crop use over the 2008-2015 period. Using this dataset, we estimate

[3] Based on outreach to multiple local experts who confirmed an average yield of 5 tons/acre and moisture content of 10%. Research in Illinois has shown yields to range from 1.5 tons/ac to 8.4 tons/ac (1.3 bdt/ac to 7.6 bdt/ac). https://onlinelibrary.wiley.com/doi/pdf/10.1111/gcbb.13139

[4] Landowners contacted during outreach agreed that it would be possible to encourage landowners to allow rhizome planting on marginal lands if contract terms were favorable and if the developer could provide proof of end markets for miscanthus-based products, which would provide assurances to the landowner that the miscanthus would be harvested over the long-term. In Ohio, landowners with productive agricultural land benefit from tax subsidies through the Current Agricultural Use Valuation (CAUV) Program.

[5] https://cabbi.bio/datasets/assessing-marginal-land-availability-based-on-land-use-change-information-in-the-contiguous-united-states/

that 12,500 acres of land in the Supply Basin is economically marginal and, therefore, potentially available for purposes of miscanthus cultivation. When considering the existing 2,500 acres of miscanthus croplands in the Supply Zone, the miscanthus supply potential totals 67,500 bdt/yr.

COMPETITION ANALYSIS

As of January 2025, the regional market for miscanthus is restricted to a small chopped miscanthus bagging operation (for sale on absorbent markets) and on-farm uses (e.g., bedding, animal feed). Total annual demand does not exceed 1,000 bdt/yr (200 acres). Between 2014 and 2019, a biodegradable container production facility in Ashtabula operated with a peak annual demand of approximately 15,000 tons/yr (13,500 bdt/yr), equivalent to 3,000 acres/yr. The facility was closed in 2019.[6]

RATED QUANTITIES AND PRICING

As described in the Supply Analysis subsection, the economically marginal land database indicates that there are approximately 12,500 acres of land in the Supply Zone that underwent crop to non-crop land use change over the 2008-2015 period. If this entire acreage was planted, a total of 56,250 bdt of miscanthus could be produced annually. When combined with miscanthus supplies available from existing cropland (11,250 bdt/yr), the total amount of miscanthus biomass available is 67,500 bdt/yr.

The portion of economically marginal land in the Supply Zone that is successfully converted to miscanthus production will depend on landowners' willingness to lease for purposes of miscanthus production, soil conditions, and other factors. To account for these uncertainties, a Biomass Availability Multiple (BAM) of 4.0x was applied to the potential quantity that could be available from new miscanthus cropland (56,250 bdt/yr). This results in a total of 14,063 bdt/yr, equivalent to an acreage of 3,125 acres. Rounded down to 3,000 acres, this leads to a biomass availability estimate of 13,500 bdt/yr from new miscanthus cropland over a scale-up period of six years. Combined with supply from existing 2,500 acres (11,250 bdt/yr), total rated quantity equals 24,750 bdt/yr.

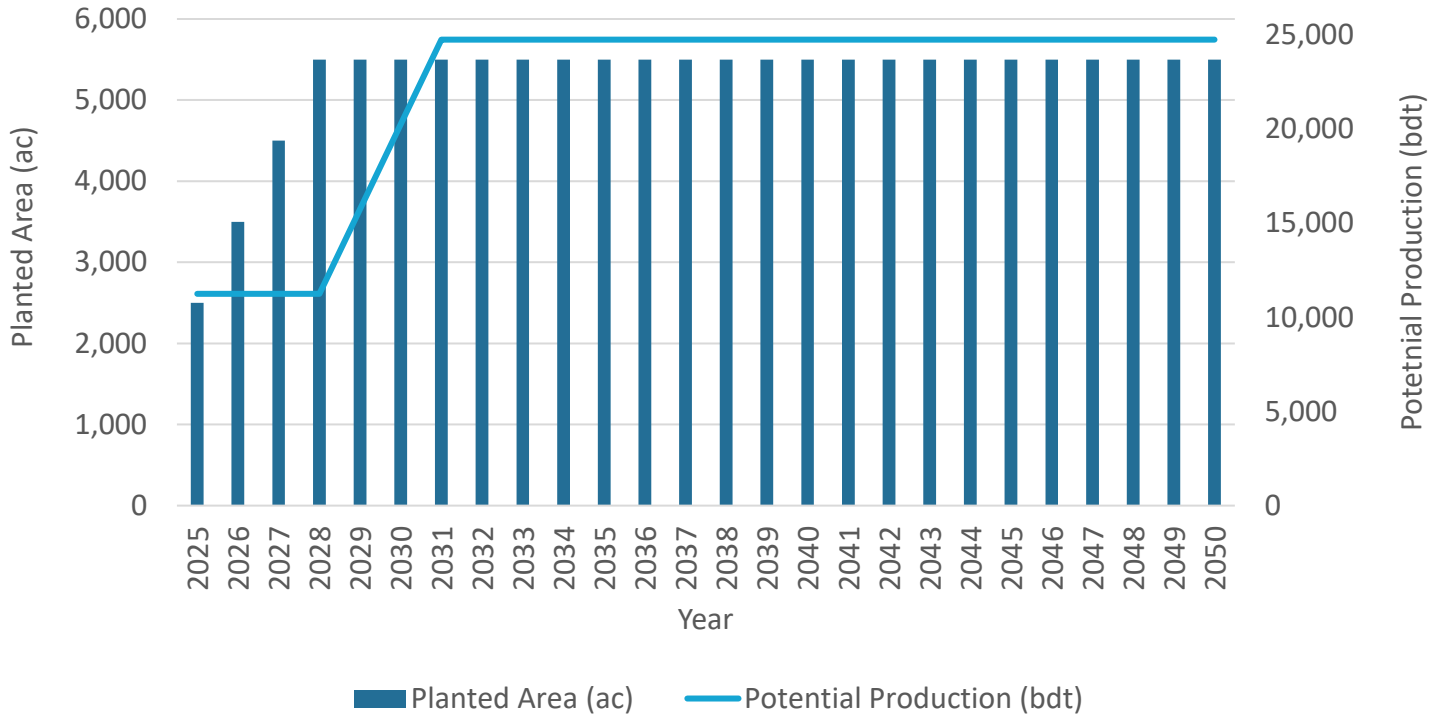
Table B-3. Available and Rated Quantities and Corresponding Rated Price Range for the Evaluated Feedstocks

Feedstock Type	Available Quantity (bdt/yr)	Rated Quantity (bdt/yr)	Rated Price Range ($/bdt delivered)
Miscanthus	67,500	24,750	135-175

The miscanthus supply scenario used to determine the rated quantities and prices, and against which risks were evaluated, is illustrated in Figure B-1. It is assumed that 1,000 acres of miscanthus is planted annually between 2026 and 2028, leading to a total planted acreage of 5,500 acres in the Supply Zone (3,000 acres of new miscanthus cropland in addition to the 2,500 acres of existing miscanthus cropland). The maximum production level of 24,750 bdt/yr is only reached in 2031 due to the three-year delay between miscanthus crop establishment and initial harvesting. Therefore, peak production is reached over a scale-up period of six years.

[6] Star Beacon. Aug.17, 2019. Aloterra Packaging in Ashtabula closing; 39 full time jobs will be lost.

Figure B-1. Miscanthus Supply Scenario Used to Evaluate Project-Ready Quantity, Price, and Risk Profile



The delivered price of miscanthus biomass delivered to a facility located within 50 miles of the City of Ashtabula is estimated to range from $135/bdt to $175/bdt. The rated price range was derived using a miscanthus production costing model that estimates costs from the perspective of a developer (Table B-1). The model annualizes the total cost of production over a 20-year time horizon and accounts for the costs of establishing new miscanthus cropland, maintaining yield through biennial nitrogen applications, and annually chopping miscanthus and transporting it to the final destination.[7]

The final delivered price range of $135/bdt to $175/bdt reflects uncertainty in agricultural land rental costs and whether government subsidies will be available to a new developer (0% vs. 50% of establishment costs). Land rental costs in Ashtabula County over the 2010-2017 period increased by 116% ($34/ac in 2010 to $74/ac in 2017), compared to an expected inflation-driven increase of only 10% (Figure E-1, Appendix E). To establish the original miscanthus cropland, government subsidies were also required. We therefore assume two scenarios, one where 50% of the establishment costs are subsidized and land lease rates are low ($75/ac), and one where no subsidies are available and land lease rates are high ($150/ac). In 2022, the delivered cost of chopped miscanthus in the region was $122/ton ($135/bdt), not including storage costs and without accounting for the initial cost of planting.[8]

[7] Harvesting of new miscanthus cropland begins in Year 3 once the crop reaches maturity.
[8] Outreach to individual currently involved in miscanthus production in the region.

Table B-1. Costing Model Used to Estimate Rated Price Range[9]

Year[10]	Land Rental ($/ac)[11]	Site Preparation ($/ac)[12]	Rhizome Planting ($/ac)[13]	Nitrogen Inputs ($/ac)[14]	Chopping-Transport ($/ac)[15]	Total Nominal Cost ($/ac)	Discount Factor[16]	Total Cost ($/ac)
0	75-150	135	460-860	0	0	670-1,145	1.00	670-1,145
1	75-150	0	0	0	0	75-150	0.95	71.43-142.86
2	75-150	0	0	0	0	75-150	0.91	68.03-136.05
3	75-150	0	0	50	625	750-825	0.86	647.88-712.67
4-19	75-150	0	0	50 (biennial)	625	750-825	0.82-0.40	290.86-637.59
20	75-150	0	0	0	625	700-775	0.38	263.82-292.09
						Total Cost Over 20 Years ($/ac)		8,502.95-9,912.62
						Annualized Cost ($/ac/yr)[17]		682.30-795.41
						Delivered Cost ($/bdt)[18]		151.62-176.76

Parameter values were assigned based on literature review and outreach to individuals who were directly involved in the previous miscanthus supply chain that operated over the 2011-2019 period. A developer would pay approximately $135/ton for biomass from existing 2,500 acres of miscanthus cropland, as no rhizome planting costs would be incurred.

OPERATIONAL CONSIDERATIONS

Miscanthus can be supplied in either baled or chopped form. Experience with miscanthus harvesting in northeast Ohio and northwest Pennsylvania over the period 2014-2019 led to the conclusion that silage harvesting techniques (chopping) and equipment were more efficient and cost-effective than baling due to regional weather and soil conditions. The wet, clay soils typical of Ashtabula County and surrounding counties (particularly in the northern watersheds that discharge into Lake Erie) can often lead to soil and moisture contamination of bales. The use of tracked choppers significantly reduces soil and moisture contamination risk by chopping standing miscanthus directly into wagons, such that soil contact is minimized. The wagons are then unloaded directly into trucks, and the chopped miscanthus is delivered to the destination.

Miscanthus chopping productivity in the study area is expected to range from two to five acres per hour. Miscanthus harvesting operations are best carried out during the winter and early spring (late November to early May). Assuming that a single chopper processes 20 acres per day and operates five days per week over a 22-week period from late November

[9] Ranges denote minimum and maximum estimates for rhizome purchasing subsidies of 50% and 0% and land lease rates of $75/ac and $150/ac.
[10] Year 0 represents the year in which new miscanthus cropland is established. We assume that new miscanthus cropland would be established sometime over a five-year period in which a developer works to lease new marginal land and negotiate contracts with landowners.
[11] Based on outreach to USDA FSA, local experts, and landowners.
[12] Includes the cost of preparing land for agricultural use and weed control (https://extension.psu.edu/miscanthus-budget-for-biomass-production).
[13] Includes the cost of purchasing rhizomes from a third party and planting the rhizomes. Based on outreach to local experts and https://extension.psu.edu/miscanthus-budget-for-biomass-production.
[14] Average cost of broadcast application of liquid fertilizer in Ohio in 2024 (https://farmoffice.osu.edu/blog/mon-07012024-900am/ohio-farm-custom-rates-2024). Nitrogen application during crop establishment could be counterproductive as this also encourages weed growth (https://extension.psu.edu/energy-crop-profile-giant-miscanthus).
[15] Based on interview with previous miscanthus supply chain manager. Includes cost of chopping miscanthus, loading into wagons, and hauling to a destination within 50 miles, and all associated overhead costs. Harvesting operations do not begin until Year 3 due to time required for miscanthus to each maturity.
[16] Based on a nominal discount rate of 5% (not adjusted for inflation). The discount factor is an adjustment for uncertainty, the opportunity cost of capital, and the time value of money.
[17] Estimated by multiplying total cost over 20 years by a capital recovery factor (CRF) defined by a 20-year project duration and a discount rate of 5%.
[18] Assumes 4.5 bdt/ac

to early April, annual production for a single unit would reach 2,200 acres per year (approximately 9,900 bdt/yr). Therefore, it is expected that three chopping units would be sufficient to ensure recovery of the rated quantities (24,750 bdt/yr, equivalent to approximately 5,500 acres/yr). A total of nine chip trucks, three attached to each chopper, would be required to ensure delivery of the rated quantity.[19]

[19] Assumes a payload of 10.8 bdt, three deliveries per day, and 110 operating days per year.

SECTION C: INFRASTRUCTURE



PROPERTY OVERVIEW

Address:	3000 Lake Road E
City:	Ashtabula
State:	Ohio
County:	Ashtabula
Acres:	80
Pricing Note:	Yes
Topography:	Flat
Zoning:	M-Industrial

SITE CONTACTS

Senior Associate/Project Manager
Sonia C. Newman
Growth Partnership for Ashtabula County
35 West Jefferson St
Jefferson, OH 44047
P: 440-576-9126
sonia@ashtabulagrowth.com

ADDITIONAL NON-RATED SITES

Infrastructure Site Contact
Bob Buckingham
BDO Zone Infrastructure
bob@ecostrat.com

PROPERTY PROFILE

The 80-acre industrial site presents a favorable infrastructure profile, with proximity to essential utilities, including gas, electricity, water, and sewer, mitigating development risks associated with utility access. The presence of surrounding commercial operations indicates an established economic environment, which may support industrial activity. A dedicated rail spur provides direct freight access, reducing dependence on trucking. The site is located within five miles of an interstate highway and is within a few miles of a primary water freight port, offering multimodal shipping options.

Transportation

Nearest Highway: US 531/20 at site
Nearest Interstate: I-90 (5 miles)
Nearest Airport: NE Ohio Regional (10 mi)
Nearest Commercial Airport: Erie, PA (40 mi), Cleveland, OH (70 mi)
Rail Served: Yes
Rail Accessible: Yes, spur to site – CSX
Water Freight: Yes
Distance to Nearest Port: Ashtabula Port Authority (2 mi)

Electric Service

Supplier: Illuminating Company
Ownership: First Energy
Phone: 800-589-3101
Capability: 12.5 kV / 25 kV for distribution, up to 15 MW available
All Utilities Extend to Site: Yes
Nearest Substation: 0.25 mi
Website: www.findenergy.com/providers/illuminating-company/

Natural Gas

Supplier: AEP Energy
Ownership: Private
Phone: 866-258-3782
Capability: Gas service to site
Size of Main: 12"
Pressure: 50 psi
Website: www.aepenergy.com

Water

Supplier: Ashtabula County Water Dist.
Ownership: Municipal
Phone: 440-576-9090
Capability: 1,000,000 gals per day
Size of Main: 12"
Website: www.ashtabulacounty.us/229/Water-Utility-Information

Wastewater

Supplier: Ashtabula County Dept of Environmental Services
Ownership: Municipal
Phone: 440-576-9090
Capability: 1,000,000 gal per day
Size of Main: 10" main line with several gravity lines
Website: www.ashtabulacounty.us/230/Sewer-Utility-Information

Telecommunications

Supplier: Spectrum Communications
Ownership: Private
Phone: 844-294-9987
Capability: Primary wireless and fiber optics available up to 5G service
Platforms: Fiber, wireless
Website: www.spectrum.com/internet

SECTION D: RISK INDICATOR SCORING METRICS

CATEGORY 1.0: SUPPLIER RISK

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

1.1.1 Longevity & History of Supplier Performance

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

Risk Information: The miscanthus supply chain that operated in the region from 2014 to 2019 involved a third-party harvesting company, company-owned and third-party truck fleets (depending on year), approximately 100 landowners, and company management personnel. With the exception of the landowners that have removed their miscanthus crops since 2020, each of these supply chain actors remains in business and is capable of contributing to a future miscanthus supply chain. However, establishing contracts with new landowners will be challenging due to negative experience with the previous developer (Aloterra). This historical pattern of discontinued operations and landowner dissatisfaction contributes to very high likelihood of supplier performance risks for any new project.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very high, therefore the RRL is 10 out of 10.	**10**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	**80**
Mitigation/Notching	**Notch**
RRL Mitigation (Notch) There are many individuals and organizations with expertise in miscanthus production that are committed to realizing the full potential of the regional miscanthus resource. This includes the USDA Farm Service Agency – Ohio office, which is directly involved in federal legislative actions (e.g., negotiations around of the 2024 Farm Bill) and equipment operators and supply chain managers who formerly worked with Aloterra. The risk posed by the lack of existing suppliers is therefore mitigated by the experience of individuals and organizations that stand to contribute to the establishment of a new supply chain in the region. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	**25%**
Loaded RI Score	**Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 60 out of 100.	**60**

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

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

Rationale: Suppliers may have a vested interest or preference in supplying specific competitors with biomass feedstock. Preferences may be due to historical, long-term, or personal relationships, less stringent feedstock quality requirements, more flexible operating hours by competing markets, or suppliers' dependence on competing markets to accept or purchase other products/by-products. During periods of feedstock shortage, such suppliers may be more likely to allocate the scarce supply to competitors, resulting in supply disruptions for the Issuer.

Risk Information: Annual miscanthus harvesting activity in recent years has approximated 700 tons/yr, or 140 acres/yr. This is equivalent to 0.6% of current miscanthus acreage and 0.3% of the total acreage of miscanthus that would be planted under the supply scenario. The company that is currently bagging and selling miscanthus is not expected to

increase production. Due to the minimal current demand for miscanthus from alternative markets, the risk of suppliers prioritizing other buyers is very low.

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

1.3 Risk Factor: Supplier Control Over Production and Transportation

1.3.1 Ownership of Land/Means of Production

Rationale: The ownership (or control) of the land base on which biomass feedstock is produced can have significant impact when an Issuer is assessing biomass feedstock risks. Suppliers that own land where biomass feedstock is produced tend to have better control of supply chains and present lower degrees of supply risk. However, in instances when a developer must lease land from private landowners in order to produce a feedstock, risk is elevated.

Risk Information: All existing and potential future miscanthus cropland is/will be owned by private landowners with parcels ranging from 10 to 60 acres. A developer will have to establish new leasing contracts with existing owners of miscanthus cropland, which could prove difficult given that the same landowners did not benefit from the previous project. Risk associated with ownership of land is significantly elevated for the additional 3,000 acres of miscanthus cropland that will need to be established to ensure supply of the rated quantity. This fragmented ownership pattern and history of unsuccessful prior engagements yields high risk levels for securing consistent production access.

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

1.3.2 Ownership of Equipment

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

Risk Information: Equipment required to harvest, collect, and process miscanthus is owned by small companies that operate in the region. The chopper (CLAAS) that was employed in the service of the previous miscanthus supply chain is owned by a small custom owner-operator in New York State. It was confirmed through outreach that this piece of equipment would be available for a new miscanthus project. To reliably harvest the rated quantity, two additional choppers would be required (purchased by a proponent or third party). The cost of a new chopper ranges from $750,000 to $1,000,000. The need for substantial equipment investment and reliance on limited third-party resources creates medium likelihood but high impact risk for equipment availability

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

1.3.3 Ownership of Transportation/Logistics

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

Risk Information: Transportation equipment used in support of the previous miscanthus supply chain included open top trailers owned by a local transportation service company and walking floor trailers owned by the miscanthus product manufacturer (Aloterra). Neither ownership type is likely to lead to unreliable or overpriced deliveries of chopped miscanthus. The availability of suitable transportation options in the region minimizes risk related to transportation equipment access.

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

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

1.3.4 Feedstock as a Secondary Transformation

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

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

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

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

Risk Information: Miscanthus cultivation and supply is not dependent upon the production of other, higher value products. Therefore, this indicator is not rated.

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

1.4 Risk Factor: Supplier Experience

1.4.1 Fundamental Feedstock Production Experience

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

Risk Information: Over the period 2011-2017, miscanthus was planted on a total of approximately 5,000 acres of marginal cropland in the Supply Zone. Peak production of 13,500 bdt/yr was reached in the year 2017. As of 2024, approximately 2,500 acres of miscanthus cropland remains and annual production of chopped miscanthus is only 700 tons/yr. The manager of the previous miscanthus supply chain remains involved in miscanthus production and is interested in resuming planting and harvesting operations at scale. All companies that were formerly involved in miscanthus planting, chopping, and hauling phases remain operational in the region, with the exception of the value-added manufacturer. Risk is elevated because peak production was not sustained for longer than a few years and because only one chopper was operational. Managing three choppers and associated equipment will likely be challenging owing to small parcel sizes and geographically distributed acreage. This combination of factors generates high risk for fundamental feedstock production.

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

1.4.2 Production Scale Experience

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

Risk Information: As noted in Risk Indicator 1.4.1, miscanthus production peaked at 13,500 bdt/yr in 2017. Miscanthus production was not maintained at peak levels for more than a few years under the previous proponent and therefore risk is assessed as high. Consistent production of the rated quantity on an annual basis using three choppers and supporting equipment will require careful logistics management and trial-and-error.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed high, therefore the RRL is 8 out of 10.	**8**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed high, therefore the RRI is 8 out of 10.	**8**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 64 out of 100.	**64**
Mitigation/Notching	**Notch**

RRL Mitigation (Notch) No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 64 out of 100.	**Score** **64**

1.5 Risk Factor: Supplier Harvesting/Collection/Processing Capacity

1.5.1 Supplier's Equipment Efficiency

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

Risk Information: The efficiency of miscanthus chopping in the region is typically in the range of two to five acres per hour. Equipment efficiency significantly decreases when operating in particular areas within the Supply Zone where miscanthus plots are small and/or geographically dispersed. In these situations, the chopper, wagons, and chip trucks must be frequently moved from crop-to-crop, thereby reducing the percentage of scheduled machine hours when productive work occurs. Inclement weather can also significantly reduce chopping efficiency. These operational challenges constitute high risk for equipment efficiency and overall production capacity.

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

1.6 Risk Factor: Supplier Motivation

1.6.1 Feedstock Production Priority

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

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

Risk Information: Miscanthus is a dedicated biomass crop that does not impede the production of alternative feedstocks or products. Therefore, this indicator is not rated.

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

CATEGORY 2.0: COMPETITOR RISK

2.1 Risk Factor: Influence on Feedstock Supply of Existing Markets

2.1.1 Competitors' Locations and Overall Geographical Influence

Rationale: Competitors' locations relative to siting locations within a BDO Zone can affect the viability of procuring feedstock and the cost of that feedstock. Accurate and detailed competitor mapping provides an understanding of a competitor's geographical influence on new plants within a BDO Zone, including competitive advantages such as short hauling.

Risk Information: The only competitor for miscanthus in the Competition Zone has procured a maximum of 700 tons/yr in recent years and there are plans to phase out operations. This minimal competitive presence results in very low risk from market competition.

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

2.1.2 Current and Historical Consumption of Feedstock Quantity

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

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

Risk Information: Between 2014 and 2019, a biodegradable container production facility in Ashtabula was operating with a peak annual demand of approximately 13,500 bdt/yr, equivalent to 3,000 acres/yr. The facility was closed in 2019. Risk is assessed as medium because the closure has led to skepticism on the part of potential suppliers of a new project. There are no other current or prior competitors for the miscanthus grown in the Competition Zone. This lack of established markets creates medium risk through supplier hesitancy.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. — **6**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed medium, therefore the RRI is 6 out of 10. — **6**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 36 out of 100. — **36**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100. — **36**

2.1.3 Competitor Pricing and Price Sensitivity

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

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

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

Risk Information: There are no significant competitors present in the Competition Zone. The market price for chopped miscanthus in the region has always been determined by the costs of chopping and hauling miscanthus. The cost of chopping and hauling miscanthus (including overhead costs but not including crop establishment and fertilization costs) ranges from $125-$150/ton.[20] This market pricing structure carries very low risk for competitive price pressures.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed very low, therefore the RRL is 2 out of 10. — **2**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed very low, therefore the RRI is 2 out of 10. — **2**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 4 out of 100. — **4**

[20] Based on outreach to the individual who managed the regional miscanthus supply chain during peak production.

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

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

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

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

Risk Information: There is no risk that the current purchaser of miscanthus will significantly increase feedstock demand. Current demand does not exceed 700 tons/yr and the owner communicated his intention to cease operations in the near future. The absence of growing competitive demand results in very low risk for future market pressure.

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

2.1.5 Soft Supply Influence of Existing Markets

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

Risk Information: Current demand for miscanthus is from a single company that does not source more than 700 tons annually. This minimal competitive presence creates very low risk from soft supply influences.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

2.1.6 Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can drive feedstock demand in unusual circumstances. A BDO Zone Rating Issuer based on corn stover as a feedstock, for example, would not typically compete with higher-end animal feed markets due to quality issues. However, in times of significant hay shortage (e.g., during drought), farmers use corn stover in place of hay, driving the price of feedstock and decreasing availability for bio-projects.[21]	
Risk Information: The small quantities of miscanthus sourced annually from the Supply Zone are used to produce bulk absorbent and there are no established alternative uses for miscanthus in the region. This lack of alternative market applications contributes to very low risk of temporary market-driven competition.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed very low, therefore the RRL is 2 out of 10.	**Score** **2**
Raw Risk Impact (RRI) The risk impact is deemed very low, therefore the RRI is 2 out of 10.	**Score** **2**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 4 out of 100.	**Score** **4**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 4 out of 100.	**Score** **4**

[21] Bergtold, 2018.

2.2 Risk Factor: Specific Competitors' Competitive Advantage

2.2.1 Relative Inventory Capacity

Rationale: The more inventory a competing biomass facility is able to store, the more competitive pressure it can exert on supply. The ability to store large inventories allows competitors to purchase inventory when the prices are low, potentially giving it an economic advantage. Additionally, the ability to store inventory during feedstock supply surpluses can enable competitors to continue to intake feedstock when the Issuer's plant (with lesser inventory capacity) may be forced to put suppliers on quota. Larger inventory capacity on the part of competing markets creates supplier loyalty and can make it more difficult for new projects to secure supply without paying a significant premium.

Risk Information: Current demand for miscanthus is negligible and there is therefore no risk of competitors' relative inventory capacity. This factor represents very low risk.

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

2.2.2 Relative Accessibility/Delivery Hours and Wait Times

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

Risk Information: Current demand for miscanthus is negligible and there is therefore no risk of competitors' relative accessibility. This factor constitutes very low risk.

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

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

2.2.3 Relative Specification Advantages

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

Risk Information: Current demand for miscanthus is negligible and there is therefore no risk of competitors' relative specification advantages. This aspect carries very low risk.

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

2.2.4 Demand for Competitors' Products

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

Risk Information: Since the initial planting of miscanthus in 2011/12, a number of product lines have been identified as potential means of generating profit, including pellets for co-firing in coal power plants, liquid biofuels, heating pellets, animal bedding, paper products (including COVID masks), absorbents, biodegradable packaging, and cellulose nanocrystals. A sustained effort to commercialize miscanthus-based biodegradable packaging in collaboration with Chipotle eventually failed as a result of technical and economic production barriers and Aloterra's declaration of bankruptcy in 2019. The miscanthus-based absorbent product that is currently produced from approximately 700 tons/yr of chopped miscanthus has been sold to the oil industry. The limited success of previous commercialization efforts minimizes risk of competitors' product demand creating market pressure.

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

No adjustment.

RRI Mitigation (Notch)
No adjustment.

The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).

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

CATEGORY 3.0: SUPPLY CHAIN RISK

3.1 Risk Factor: Feedstock Availability

3.1.1 Biomass Availability Multiple (BAM)

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

Risk Information: A BAM of 4.0x was applied to the estimated amount of miscanthus that could be produced from conversion of all economically marginal land in the Supply Zone to miscanthus cropland (12,500 acres). The resulting estimate of 14,062.5 bdt/yr is equivalent to 3,125 acres. This acreage was rounded down to 3,000 acres, leading to an estimate of 13,500 bdt/yr of miscanthus production from new miscanthus cropland. When combined with miscanthus supply from the existing 2,500 acres of miscanthus cropland in the Supply Zone (11,250 bdt/yr), the total rated quantity of 24,750 bdt/yr is equivalent to approximately one-third of the theoretical potential.

While this estimate provides some redundancy against potential difficulties in securing new leasing agreements with landowners and other factors, sustained production of this amount has not been proven. Miscanthus is a feedstock that remains in an early stage of research, development, and demonstration. Aspects of miscanthus agronomy remain uncertain, including longevity, optimal fertilization levels, and other factors. The dataset used to estimate economically marginal land also introduces significant uncertainty. Economically marginal land is defined in the dataset as land that underwent crop to non-crop land use change over the 2008-2015 period, as measured using satellite imagery. The specific reasons for the land use change are unknown. More accurate measures of the marginality of land are not available (e.g., profitability of land). More time-intensive surveys of landowners' willingness to enter into leasing agreements with a new miscanthus developer are required. These factors collectively create very high risk for biomass availability.

Raw Risk Likelihood (RRL)	**Score**
The risk likelihood is deemed very high, therefore the RRL is 10 out of 10.	**10**
Raw Risk Impact (RRI)	**Score**
The risk impact is deemed very high, therefore the RRI is 10 out of 10.	**10**
Gross Risk Indicator (GRI)	**Score**
The Gross Risk Indicator (RRL X RRI) is 100 out of 100.	**100**
Mitigation/Notching	**Notch**
RRL Mitigation (25%) Many of the individuals who were involved in the management and operation of the miscanthus supply chain during peak production years remain involved in current miscanthus production in the region (~700 tons/yr). The previous manager of the miscanthus supply chain for Aloterra has technical knowledge relevant to all	**25%**

supply chain phases, including downstream processes involved in final product production, promotion, and sales. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is 25%.
Loaded RI Score — **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 75 out of 100. — **75**

3.1.2 Feedstock Supply Curve/Marginal Cost Curve

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

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

Risk Information: Existing miscanthus cropland is concentrated in Ashtabula County, mostly within a 30-mile drive distance of the City of Ashtabula. We expect that a developer will concentrate additional miscanthus cropland within this area to minimize transportation costs but the economically marginal land dataset indicates that a larger transportation distance may be required (Figure E-2, Appendix E). Therefore, feedstock transportation distance is assessed to pose a medium risk to the rated quantities. Elevated transportation costs due to the low bulk density of miscanthus are accounted for in the rated price range. The transportation distance requirements yield medium risk for feedstock supply curve considerations.

Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100.	**Score** **16**

3.1.3 Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal variations. Seasonal supply variations, combined with limitations associated with longer-distance transportation and storage, can lead to BDO Zone biomass supply imbalances,[22] which can manifest in shortages and higher costs for Issuers.

Risk Information: The harvest window for miscanthus is during the winter (late November-early May), once frost has killed the aboveground component, sufficient time has elapsed for nutrient translocation to belowground components (rhizomes), and before the rhizomes sprout new stems in the spring. In the spring, the belowground component of the rhizomes sprout new stems, and a new development cycle begins. Winter harvesting operations in NE Ohio can be affected by subzero temperatures, storms, and snow accumulation. Risk is elevated due to the relatively small size and high geographic dispersion of miscanthus crops in some areas. Risk is moderated by the fact that farmers and associated harvesters/equipment operators are familiar with winter operations due to their previous experience supplying Aloterra. These seasonal factors create medium risk for supply variations.

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

3.1.4 Year-to-Year Variation in Feedstock Availability

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

Risk Information: The rated price range was estimated by assuming that nitrogen fertilizer is added each year to ensure consistent regrowth of miscanthus on an annual basis. Annual applications would possibly amount to 100 lbs/ac (111 kg/ha). However, ensuring the rated quantity is produced annually remains uncertain due to poor soils, the potential for low miscanthus yields on marginal land, and the fact that consistent year-to-year supply of miscanthus has not been demonstrated in the region for more than a few years. These factors contribute to medium likelihood but high impact risk for year-to-year feedstock availability.

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

[22] Golecha & Gan, 2016.

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

3.2 Risk Factor: Historical Issues

3.2.1 Historical Feedstock Price Variations

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

Risk Information: Miscanthus production and supply in the region has not been subject to strong market forces. Once miscanthus crops were established through subsidies under the previous project, the developer (Aloterra) incurred all variable, capital, and overhead costs required to supply the chopped miscanthus to the facility. Vertical integration and a lack of alternative buyers led to a situation where the delivered "price" paid by the developer was equivalent to the incurred costs. We expect that a new developer would have a similar cost-based supply chain. We confirmed through outreach to the previous supply chain manager that delivered costs did not vary significantly. Although input cost prices (e.g., diesel) can be expected to vary to some extent in future years, this is not a significant risk. This cost stability results in low risk for price variations.

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

3.2.2 Historical Demand for Feedstock in the BDO Zone

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

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

Risk Information: Peak production under the previous project reached levels near the rated quantity. However, production at this level was not sustained for more than a few years. A new developer would likely need to invest or contract out two additional choppers to ensure that the rated quantity is supplied continuously on an annual basis. The equipment operator(s) associated with the new choppers is/are unlikely to have direct experience chopping and offloading miscanthus at scale. Risk is moderated by the presence of regional knowledge on proper miscanthus supply chain management. These factors create medium risk for historical demand patterns.

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

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

Rationale: If 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. Secondary crops or by-product producers may be less likely to prioritize production.

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

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

Risk Information: Accessing the rated quantity will require planting approximately 3,000 acres of additional miscanthus cropland in the area. Knowledge and equipment associated with the establishment of 5,000 acres of miscanthus cropland between 2011 and 2017 is still present in the region and available for new developers. A chopper and associated wagons, chip trucks, and managerial capacity also remain available. However, two additional choppers and supporting wagons and trucks would likely be required to ensure consistent supply. Regional supply chain managers have not managed operations at this scale before. Risk is also elevated due to the fact that miscanthus production at peak levels was not sustained for more than a few years. These factors constitute high risk for establishing sustainable production.

Raw Risk Likelihood (RRL)	**Score**

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

3.3 Risk Factor: Non-Weather Based Externalities

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

Rationale: CPI and PPI can impact feedstock cost of harvest and collection over time. Sensitivities to worst-case scenarios should be run.	
Risk Information: Although inflation rates have stabilized since the 2021-2022 COVID-19 pandemic, the long-term outlook for inflation remains uncertain.[23] This economic uncertainty generates medium risk for CPI and PPI impacts.	
Raw Risk Likelihood (RRL) The risk likelihood is deemed medium, therefore the RRL is 6 out of 10.	**Score** **6**
Raw Risk Impact (RRI) The risk impact is deemed medium, therefore the RRI is 6 out of 10.	**Score** **6**
Gross Risk Indicator (GRI) The Gross Risk Indicator (RRL X RRI) is 36 out of 100.	**Score** **36**
Mitigation/Notching *RRL Mitigation (Notch)* No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).	**Notch** **NN**
Loaded RI Score The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100.	**Score** **36**

3.3.2 Currency Risk

Rationale: Where feedstock is purchased in a currency different than that which a new bio-based plant will locate in a BDO Zone, currency exchange rates and volatility can constitute risk exposure. BDO Zones that cross the US-Canada border, for example, which intake feedstock from both countries, are exposed to such currency risk.	
Risk Information: Not relevant.	
Raw Risk Likelihood (RRL)	**Score**

[23] https://www.bls.gov/cpi/

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

3.3.3 Border Risk

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

Risk Information: Not relevant.

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

3.3.4 Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances. For example, an Issuer using corn stover as a feedstock would not typically compete with the higher-end animal feed market. However, in times of significant hay shortage (e.g., during drought), farmers may use corn stover as hay replacement, driving the price of stover feedstock and decreasing its availability for bio-projects.[24]

Risk Information: There are no significant alternative markets for miscanthus in the region. Miscanthus has been used as an animal bedding material but only in small quantities. This absence of alternative markets leads to very low risk from externality-driven market factors.

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

[24] Bergtold, 2018.

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

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

3.4.1 Harvest & Collection Practices & Schedules

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

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

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

Risk Information: Since 2011, trial-and-error has led to gradual improvements in miscanthus harvesting and collection practices. Since 2016, the most effective harvesting practice has involved chopping using tracked CLAAS choppers with simultaneous loading and transport of chopped miscanthus using silage wagons. This method avoids ground contact and helps to ensure that moisture content does not exceed 15%, particularly during periods of snow accumulation. If chopped miscanthus is not immediately loaded from the wagons into semi-trailers, it is loaded into silage bags on site.

Windrowing, raking, and baling was attempted in initial years but exposure of windrowed miscanthus to the elements led to excessive moisture content.[25] In addition, rhizome planting operations require specialized knowledge and equipment, both of which remain available in the region. Risk is elevated by the potential for seasonal weather (e.g., heavy snowfall, muddy soils in warm winters) to impact future harvesting operations, particularly for inexperienced operators of choppers and other supply chain equipment. These operational challenges create medium risk for harvest and collection practices.

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

[25] https://ashtabula.osu.edu/sites/ashtabula/files/imce/Program_Pages/ANR/Miscanthus/harvestingmiscanthusarticle-marrison2016.pdf

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

3.4.2 Harvesting & Collection Equipment

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

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

Risk Information: It is generally agreed by individuals who were involved in the previous miscanthus supply chain that chopping is more efficient and cost-effective than baling due to the prevalence of heavy clay soils. Heavy-duty choppers (e.g., CLAAS brand) have already been proven. It is expected that any future supply chain will involve the use of choppers and associated equipment, therefore risk is low for harvesting and collection equipment selection.

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

3.4.3 Variation in Densification Methods Among Different Suppliers

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

Bales of different densities can absorb moisture at different rates. In certain cases, round bales have been viewed as problematic due to their uneven moisture content distribution.[26]

Risk Information: When applied to miscanthus, disc choppers (e.g., CLAAS) have been demonstrated to consistently produce a two to three inch particle size (similar to sileage). Since a future miscanthus supply chain is expected to

[26] Huhnke, 2018.

involve the use of choppers, and since supply chain oversight will likely involve knowledge from previous operators/managers, risk is assessed to be low.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. **16**

3.4.4 Availability of Labor for Feedstock Production

Rationale: Skilled labor shortages can be difficult to remedy in the short term. The availability of suitable labor in an area can impact the ability to procure sufficient feedstock quantities on required schedules. Labor risks are higher where supply chains are not yet active or for Issuers for whom large feedstock requirements or the development of new (or expanded) supply chains demand significant additions to the local labor force.
Risk Information: Ensuring that the rated quantity is produced and delivered annually would require three chopper operators and approximately nine truck operators. Rhizome planting operations in the initial years of supply chain development would require equipment operators and specialists that are likely to be provided by a third party. Agricultural production is common in Northeast Ohio and, therefore, a new developer is expected to have an adequate labor supply. The manager of the previous miscanthus supply chain has over a decade of experience working with agricultural producers and trucking companies in the region for purposes of miscanthus supply. In addition, Ashtabula County Technical and Career Campus (A-Tech) offers high school and adult education programs of direct relevance to a future miscanthus supply chain, including equipment operators and horticulture. The institution also offers custom programs to support new regional industries. These workforce factors result in low risk for labor availability.
Raw Risk Likelihood (RRL) **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch**
RRL Mitigation (Notch) **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).

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

3.5 Risk Factor: Transportation

3.5.1 Feedstock Transportation Costs

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

Transport distances of 50-75 miles for biomass feedstocks are typical, but larger distances can be common. Where the average transport distance from suppliers to Issuers is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and the demand for scarce feedstock from competitors closer to the source.

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

Risk Information: Trucking rates in the region are typically in the range of $120-$150/hour. It is expected that a new developer will establish the majority of new miscanthus cropland within a 50-mile transport distance of Ashtabula, as this was the practice established under the previous developer to minimize transportation costs. Risk is assessed as medium, as there is uncertainty as to whether a developer will succeed in developing leasing arrangements with landowners within 50 miles. This transportation distance uncertainty results in medium risk for feedstock transportation costs.

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

3.5.2 Diesel Cost Impacts

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

Risk Information: No.2 diesel prices in the U.S. Midwest have closely approximated average national diesel prices over the 1994-2024 period (Figure E-3, Appendix E). Significant diesel price volatility was observed in the USA (including the Midwest) over the 2021-2023 period. Current diesel prices remain near 2011-2014 levels. Risk is assessed as medium because the biomass supply curve presented in Figure E-2 indicates that a new developer may have to establish miscanthus cropland at distances of over 50 miles, increasing vulnerability to diesel price inflation. This transport distance and fuel price relationship creates medium risk for diesel cost impacts.

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

3.5.3 Transportation of Feedstock Requires Specialized Equipment

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

Risk Information: Transportation of chopped miscanthus would most likely involve the use of open-top trailers (e.g., roll-off bins) as these were used previously. There is adequate transportation capacity in the region to ensure timely delivery of the rated quantity. The availability of suitable transport equipment minimizes risk to low levels.

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

3.5.4 Delivery Routes through Local Communities

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

Risk Information: Trucking in support of the agricultural sector is common in Ashtabula County and in surrounding counties and, therefore, risk is assessed as low.

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

3.5.5 Transportation Regulations & Local Weight Limits

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

Risk Information: Seasonal road regulations do not affect trucking activity in the region. This regulatory environment results in low risk for transportation regulations and weight limits.

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

3.5.6 Road Infrastructure

Rationale: Feedstock cost and availability can be a function of road infrastructure, in particular the accessibility the infrastructure provides to feedstock. Issues with road networks will translate directly to risks to feedstock supply.

Risk Information: Road infrastructure in Ashtabula County and neighboring counties is generally in a good state of repair. No risks were identified during outreach. This infrastructure quality contributes to low risk for road conditions.

Raw Risk Likelihood (RRL)	**Score**

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

3.5.7 Transportation Redundancy

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

Risk Information: Only nine trucks would be required to support a winter-fall miscanthus supply chain involving three chopper operations. There are sufficient trucks available in the region to support the rated quantities, as evidenced by the successful procurement of miscanthus during the 2014-2019 period. Low expected average transport distances further reduce risk of inadequate truck availability. These factors result in low risk for transportation redundancy.

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

3.6 Risk Factor: Supply Chain Resiliency

3.6.1 Size, Number, and Location of Suppliers

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

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

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

Risk Information: There are currently about 60 landowners with miscanthus cropland located in the Supply Zone.[27] The number of landowners would likely double if a new project developer was successful in leasing an additional 3,000 acres of land for miscanthus production. The large number of suppliers mitigates risks associated with any potential region-wide natural disturbances that could curtail miscanthus production. There is, however, significant risk associated with encouraging new landowners to allow their land to be leased for purposes of miscanthus production. Many individuals contacted during outreach noted that landowners are very skeptical of miscanthus due to the failure of the previous project. Risk is moderated by the lack of alternative uses of marginal lands upon which miscanthus crops have, and are expected to be, established. These factors create medium risk related to common external risk factors..

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

3.6.2 Suppliers Subject to Same External Risk Factors

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

Risk Information: There are currently about 60 landowners with miscanthus cropland located in the Supply Zone. The number of landowners would likely double if a new project developer was successful in leasing an additional 3,000 acres of land for miscanthus production. The large number of suppliers mitigates risks associated with any potential region-wide natural disturbances that could curtail miscanthus production. There is, however, significant risk associated with encouraging new landowners to allow their land to be leased for purposes of miscanthus production. Many individuals contacted during outreach noted that landowners are very skeptical of miscanthus due to the failure of the previous project. Risk is moderated by the lack of alternative uses of marginal lands upon which miscanthus crops have, and are expected to be, established. These factors create medium risk related to common external risk factors.

Raw Risk Likelihood (RRL)	**Score**

[27] Assumes 40 acres per landowner average based on data provided by the Ashtabula County Auditor's Office.

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

3.6.3 Land Ownership Structures

Rationale: The ownership (or control) of the land base on which feedstock is produced can have a significant impact on the Issuer's feedstock risks.

Risk Information: All current miscanthus crop owners are private landowners, and future miscanthus crop owners are also expected to be private landowners who lease their land for purposes of crop establishment and harvesting. Current and future miscanthus crops are, or are expected to be, planted on marginal lands, which have few competing uses. However, it will be challenging for new developers to incentivize new private landowners to lease their land for purposes of miscanthus production due to past negative experience with the previous developer, the fact that miscanthus is an early-stage biomass crop unproven at scale, and other factors. Risk is deemed to be high because the cropland required to realize the rated quantity has not yet been established. This ownership structure results in high risk for land access.

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

3.7 Risk Factor: Climate and Natural Risks

3.7.1 Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as those deriving from natural weather variations (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.

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

Risk Information: Due to the heavy clay soils in the area, miscanthus chopping operations are ideal during periods of subzero temperatures when the ground is frozen (late November to early April). Snowfall accumulation can reach up to five feet during the months of December-March. Chopping and hauling operations are not possible under these conditions, which can lead to up to a two weeks of downtime during the harvesting window in winter and early spring. During warm winters, chopping operations would likely have to be delayed until late winter (e.g., late February-March), reducing the harvest window and potentially compromising supply of the rated quantity.

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

3.7.2 Long-Term Weather and Climate Trends

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

Risk Information: The average annual temperature in Ohio has risen by about 1 degree Fahrenheit since the early 20th century. Average annual precipitation has also increased by several inches. This has resulted in marginal increases in flooding risk in Ohio.[28] Agricultural productivity has increased over the past century in Ashtabula County, indicating that potential impacts of climate change (e.g., flooding) have not significantly impacted the industry (Figure E-4). These climate trends generate low risk for long-term weather impacts.

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

[28] https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-oh.pdf

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

3.7.3 Forest/Crop Fire

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

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

Other climate change impacts that could add damaged or dead wood to the forest fuel load (e.g., as a result of insect outbreaks, ice storms, or high winds) may increase the risk of fire activity. New research is aimed at refining these climate change estimates of fire activity and investigating adaptation strategies and options to deal with future fire occurrences. There is growing consensus that as wildfire activity increases, fire agency suppression efforts will be increasingly strained.

Risk Information: Crop fires are uncommon in the region. Risk is therefore deemed to be very low.

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

3.7.4 Risk of Infestation

Rationale: Risk of future infestation, including its estimated consequences on feedstock supply, should be calculated into the overall risk profile.

Since forest insect populations are influenced by environmental conditions, future changes in climate can be expected to significantly alter the outbreak dynamics of certain forest insect species. In some cases, larger and more frequent insect outbreaks may occur, but in other cases, recurring outbreaks may be disrupted or diminished. As the climate continues to change, we can expect more situations, particularly at the margins of tree ranges, where sub-optimal conditions for tree growth and reduced tree vigor can lead to outbreaks of forest insects.

Risk Information: There have been no significant pest infestations of miscanthus crops in North America to date. However, miscanthus is known to be susceptible to the western corn rootworm, albeit with lower incidence of pest emergence compared to corn crops.[29] Overall, risk is assessed as low.

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

3.7.5 Risk of Hail

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

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

Risk Information: While hailstorms are known to occur in the region, there is no evidence that such storms have affected miscanthus croplands. Miscanthus is a woody perennial crop that has been shown to be resilient to natural disturbances. While a major hailstorm event could conceivably destroy miscanthus cropland, this is regarded as highly unlikely. These factors contribute to very low likelihood but low impact risk for hail damage.

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

[29] https://www.agrikinetics.com/miscanthus-giganteus/ecology-of-miscanthus-giganteus/

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

3.7.6 Risk of Flood

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

Risk Information: Flooding of agricultural fields in the region is known to occur but this has not affected miscanthus crops and long-term agricultural productivity. This historical performance results in low risk for flood impacts.

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

3.7.7 Risk of Drought

Rationale: Droughts can cause significant disruptions to feedstock supplies across entire BDO Zones for extended periods of time, especially in the case of agricultural residues and energy crops.

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

Risk Information: Droughts occur approximately once a decade in Ohio and can last for two to five years.[30] A drought in the early 2010s affected a portion of the miscanthus that had been established. The risk of drought is assessed as medium due to the frequency of drought and the known impact that drought can have on miscanthus growth and yield.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed medium, therefore the RRL is 6 out of 10. **6**
Raw Risk Impact (RRI) **Score** The risk impact is deemed medium, therefore the RRI is 6 out of 10. **6**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL X RRI) is 36 out of 100. **36**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score **Score** The Loaded RI Score ((1-Total Notch) X GRI Score) is 36 out of 100. **36**

3.7.8 Risk of Hurricanes, Tornadoes, and Strong Winds

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

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

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

Risk Information: Strong winds are unlikely to impede the ability for developers to access the rated quantity of miscanthus. However, during the winter months, storms can impede agricultural operations. Risk is assessed as low.
Raw Risk Likelihood (RRL) **Score** The risk likelihood is deemed low, therefore the RRL is 4 out of 10. **4**
Raw Risk Impact (RRI) **Score** The risk impact is deemed low, therefore the RRI is 4 out of 10. **4**
Gross Risk Indicator (GRI) **Score** The Gross Risk Indicator (RRL X RRI) is 16 out of 100. **16**
Mitigation/Notching **Notch** *RRL Mitigation (Notch)* **NN** No adjustment. *RRI Mitigation (Notch)*

[30] https://changingclimate.osu.edu/assets/pubs/rogers-1993.pdf

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

3.7.9 Risk of Low Temperatures

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

Risk Information: Freezing temperatures have not affected miscanthus yields or harvesting operations in the Supply Zone and therefore risk is assessed as low.

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

3.8 Risk Factor: Political and Social

3.8.1 Government Subsidies for Feedstock Production or Utilization

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

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

Risk Information: Miscanthus production in the region has been strongly dependent on government subsidies and associated rules and regulations. Miscanthus planting and production commenced in 2011 under the BCAP program, which awarded $5.7 million to Aloterra. This money was allocated to subsidize Aloterra's establishment of miscanthus crops in the region (up to 75% of initial costs) and to ensure annual lease payments to landowners of between $40-$100 per acre.[31]

[31] https://www.farmanddairy.com/news/after-a-false-start-miscanthus-stutters-into-a-new-era/649046.html; https://www.brown.senate.gov/newsroom/press/release/brown-announces-news-usda-funds-that-will-create-up-to-1-210-new-clean-energy-jobs-in-northeast-ohio-by-enabling-farmers-to-grow-biomass-crop ; Star Beacon. Feb.26, 2011. Green industry hangs on federal funding. Author: Carl E. Feather

A new developer seeking to establish a miscanthus supply chain capable of regularly supplying the rated quantity of miscanthus would not necessarily require government subsidies. For example, if a high-value product was being produced, a developer could tolerate the large up-front cost. In many cases, however, a developer may require some level of subsidization to establish the additional 3,000 acres required to secure the rated quantity. This subsidy dependency creates high risk for government support requirements.

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

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

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

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

Risk Information: Existing and potential miscanthus cropland is privately owned and not dependent on, or strongly influenced by, regulations. Risk is assessed as low.

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

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

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

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

Risk Information: Public sentiment towards miscanthus is mixed. Landowners' previous experience with miscanthus production was generally negative. Following Aloterra's closure in 2019, landowners lost their annual lease payments, no longer qualified for the CAUV tax subsidy, and had to absorb the costs of removing the miscanthus rhizomes themselves. Miscanthus was originally planted under the auspices that it would be used for cellulosic biofuel production, but a facility was never established. A biodegradable container production facility (in Ashtabula) and an absorbent production line (in Andover) were eventually built but operations ceased within a few years.[32] Other products – in particular cellulose nanocrystals – have been suggested as an alternative but this has not led to new investments or production. Overall, the previous experience has left many landowners skeptical of the economic viability of miscanthus. This negative sentiment creates very high likelihood and high impact risk for public backlash.

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

Raw Risk Impact (RRI)	Score
The risk impact is deemed high, therefore the RRI is 8 out of 10.	8

Gross Risk Indicator (GRI)	Score
The Gross Risk Indicator (RRL X RRI) is 80 out of 100.	80

Mitigation/Notching	Notch
RRL Mitigation (Notch) A developer that is able to demonstrate that the technology and product line that is produced from the miscanthus will be commercially viable would likely reduce risk of public opposition to a renewed miscanthus supply chain. Lease payments in excess of $100 per acre and other favorable contract terms would also likely improve landowners' perceptions of a new project. *RRI Mitigation (Notch)* No adjustment. The Total Notch (RRL Notch) X (RRI Notch) is 25%.	25%

Loaded RI Score	Score
The Loaded RI Score ((1-Total Notch) X GRI Score) is 60 out of 100.	60

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

Rationale: Where new project development on or near Indigenous or First Nation land, or where near Indigenous or First Nations exert influence over feedstock producing areas, consent of, and cooperation with, Indigenous communities and First Nations decreases Issuer risk.

Risk Information: Indigenous communities do not have significant land holdings in the region and therefore risk is assessed as very low.

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

[32] https://www.farmanddairy.com/news/after-a-false-start-miscanthus-stutters-into-a-new-era/649046.html

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

3.8.5 Food Security Concerns

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

Risk Information: Miscanthus is most likely to be planted on marginal land that is not preferred for corn and soy production. However, there have been instances where miscanthus rhizomes have been planted on land suitable for corn and soy production, as evidenced by the increase in average land lease values in the region under the previous project (Figure E-1, Appendix E). This potential land use competition creates medium likelihood but low impact risk for food security concerns.

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

3.9 Risk Factor: Sustainability and Environmental Concern

3.9.1 Feedstock Sustainability

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

Risk Information: Miscanthus is a dedicated crop that is self-sustaining with minimal fertilizer amendments and is typically planted on marginal land. These agronomic characteristics result in low risk for feedstock sustainability.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. — **4**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. — **16**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).
Loaded RI Score — **Score**
The Loaded RI Score ((1-Total Notch) X GRI Score) is 16 out of 100. — **16**

3.9.2 Risk to Soil Quality

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

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

Risk Information: Soils in the region are heavy clay. Staple crops such as soybeans and corn generally require the installation of drainage tiles before planting. Miscanthus croplands that were planted over the 2012-2017 period maintained an average yield of 4.5 bdt per acre and were not affected by significant natural mortality, indicating the soil quality risks are minimal. Risk is assessed as low.
Raw Risk Likelihood (RRL) — **Score**
The risk likelihood is deemed low, therefore the RRL is 4 out of 10. — **4**
Raw Risk Impact (RRI) — **Score**
The risk impact is deemed low, therefore the RRI is 4 out of 10. — **4**
Gross Risk Indicator (GRI) — **Score**
The Gross Risk Indicator (RRL X RRI) is 16 out of 100. — **16**
Mitigation/Notching — **Notch**
RRL Mitigation (Notch) — **NN**
No adjustment.
RRI Mitigation (Notch)
No adjustment.
The Total Notch (RRL Notch) X (RRI Notch) is NN (No Notch).

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

3.9.3 Risk to Surface and Groundwater

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

Risk Information: There is very low risk that a total of 5,500 acres of miscanthus cropland will damage aquatic ecosystems in the region. Fertilizer amendments are restricted to nitrogen only and can be applied during times of year when runoff risk is minimal. Risk is assessed as very low.

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

3.9.4 Water Use

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

Risk Information: The total 5,500 acres of miscanthus cropland required to secure the rated quantity is not of a sufficient scale to pose a risk to hydrological flux. Risk is assessed as very low.

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

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

3.9.5 Pesticide Risk to Human and Ecosystem Health

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

Risk Information: Pesticide applications are generally not necessary for miscanthus production and therefore risk is assessed as low.

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

3.9.6 Risk to Wildlife and Landscape

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

Risk Information: The rated miscanthus quantities and associated acreage are not sufficiently large to pose a risk to wildlife and landscape. Risk is assessed as very low.

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

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

3.9.7 Biomass Classified as Genetically Modified Organism (GMO)

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

Risk Information: Miscanthus x giganteus is a sterile hybrid that is not genetically engineered.[33] Therefore, this indicator is not rated.

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

CATEGORY 4.0: FEEDSTOCK SCALE-UP RISK

4.1 Risk Factor: Feedstock Scale-Up

4.1.1 Feedstock Quality at Production Scale

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

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

Risk Information: Equipment operators and supply chain managers who were involved with the previous miscanthus project in Ashtabula County are still present in the area. Harvesting is expected to use conventional silage harvesting techniques and equipment. Chopped miscanthus quality can be controlled through proper timing of harvesting and proper storage. Continuous year-to-year supply of the rated quantity of miscanthus to high quality standards has not been demonstrated to date and therefore risk is assessed as medium. The limited historical production at scale creates low likelihood but medium impact risk for feedstock quality consistency.

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

[33] https://extension.psu.edu/energy-crop-profile-giant-miscanthus

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

4.1.2 Capacity of Supply Chain Components & Equipment to Scale

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

Risk Information: Planting an additional 3,000 acres of miscanthus will be challenging due to logistics and costs. We expect that the additional cropland could be planted over a period of six years under the favorable contract terms and, possibly, government subsidies. Securing three choppers and associated wagons may be challenging in initial years as previous miscanthus chopping was carried out by a contractor based in New York State who owned a specialized heavy-duty chopper. It may be possible to replace the heads of conventional corn silage choppers, thereby avoiding the added costs of bringing in machinery from out-of-state, but this has not been proven at scale.[34] These scale-up requirements result in high risk for equipment and supply chain capacity.

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

CATEGORY 5.0: INFRASTRUCTURE RISKS

5.1 Risk Factor: Physical Infrastructure

5.1.1 Land Parcel/Industrial District

Risk Information: The 80-acre parcel, a former Union Carbide rail yard, offers good potential as a build-ready greenfield site. The site extends to within 600 feet of Lake Erie, providing favorable proximity to water resources. The site is well-prepared for development with industrial zoning, with all environmental permits and primary utilities already in place. There are no building restrictions or air quality concerns. These site characteristics contribute to very low risk for land parcel suitability.

Raw Risk Likelihood (RRL) **Score**

[34] It is technically possible to install specialized heads on conventional corn silage choppers.

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

5.1.2 Ownership of Land

Risk Information: The highlighted industrial site is publicly owned by the Ashtabula County Port Authority. They are actively marketing the parcel and would consider sale or lease options on all or part. This centralized control should allow for a streamlined and consistent approach to land transactions. The clear ownership status and public entity management result in very low risk for land acquisition.

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

5.1.3 Permitting Description

Risk Information: The established permitting process, managed by the Ashtabula County Building Department, follows Ohio Building Codes and typically takes around 60 days for review and issuance.[35] The inclusion of building, air emissions, water usage, and operational permits (if applicable) ensures clarity and predictability in regulatory compliance. The structured and timely process reduces uncertainty on the part of investors. This regulatory framework creates low risk for permitting issues.

Raw Risk Likelihood (RRL)	**Score**

[35] https://www.ashtabulacounty.us/181/Building

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

5.1.4 Environmental Issues

Risk Information: The completion of both a Phase I and Phase II Environmental Site Assessment (ESA) within the last six years provides strong assurance of environmental compliance. The Phase I ESA confirmed no recognized environmental conditions (RECs) across the parcel, while the Phase II ESA, which included soil and groundwater sampling, verified that there are no contamination concerns. The absence of both current and historical environmental issues minimizes regulatory hurdles and reduces the risk of unforeseen remediation costs, making the site highly suitable for development. Risk is assessed as very low.

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

5.2 Risk Factor: Utilities

5.2.1 Natural Gas Availability

Risk Information: At $8.94/Mcf in early 2025,[36] Ohio's industrial natural gas prices have increased from $7.94/Mcf in 2024 and are 167% higher than the national average of $3.35/Mcf. This price disparity is driven by colder temperatures, reliance on interstate pipelines, and associated transport fees, making natural gas a more expensive energy option

[36] https://www.eia.gov/dnav/ng/hist/n3035oh3m.htm

compared to other U.S. regions. While AEP Energy provides industrial natural gas service in Ashtabula and the surrounding region, and 6" and 12" pipelines are available at the site's northern and western borders, the cost remains a concern. This pricing disadvantage creates high likelihood and medium impact risk for natural gas costs.

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

5.2.2 Electric Availability

Risk Information: The 80-acre industrial site in Northern Ohio is served by the Illuminating Company, a subsidiary of FirstEnergy. The site benefits from multiple high-voltage transmission lines (up to 500kV) and distribution lines (12.5kV and 25kV) from a nearby substation (less than one mile away). While much of this infrastructure was originally built to support a closed coal power plant, the existing capacity remains well-suited for industrial use.

Ohio's average electric rate (15¢/kWh as of January 2025) is 26% lower than the national average (21¢/kWh),[37] making it a cost-competitive location for energy-intensive industries. Future rate stability will depend on regulatory policies, grid investments, and FirstEnergy's transition from coal. However, with established infrastructure and lower than average pricing, the risk associated with electrical service to this site is very low. These favorable power conditions result in low risk for electricity availability.

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

[37] https://www.energysage.com/local-data/electricity-cost/oh/

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

5.2.3 Water Availability

Risk Information: The Ashtabula County Water District owns and maintains the water pipelines serving the industrial site and surrounding areas. The system was originally designed to support the cooling water needs of a power generation station, indicating a high-capacity infrastructure. The network includes over 140 miles of water mains, four elevated storage tanks, and seven booster stations,[38] ensuring stable pressure and broad coverage. Freshwater is sourced from Lake Erie and treated at the Ashtabula Water Treatment Plant, which is owned and operated by Aqua Ohio.

While the system provides a reliable and abundant water supply, potential risks include rate adjustments by Aqua Ohio and future regulatory changes affecting Lake Erie water usage. However, the infrastructure's existing capacity minimizes the risk of shortages or service disruptions. This is considered a low-risk factor for industrial operations requiring consistent water access.

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

5.2.4 Waste Disposal

Risk Information: The Ashtabula County Department of Environmental Services (ACDES) and the City of Ashtabula provide sewer and wastewater services in Ashtabula, Ohio. There are multiple access points for wastewater surrounding the 80-acre industrial site. The County also owns and operates four treatment plants within the city limits.[39]

The city operates a solid waste transfer station less than two miles from the industrial site. The average rate is $0.10/lb for nonhazardous loads.[40] A full-service landfill, operated by Waste Management, is located 12 miles west of the site in Geneva, OH. This waste management infrastructure results in low risk for waste disposal.

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

[38] https://www.ashtabulacounty.us/229/Water-Utility-Information
[39] http://www.ashtabulacounty.us/230/Sewer-Utility-Information
[40] https://www.cityofashtabula.com/sanitation

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

5.2.5 Internet Availability

Risk Information: Internet service in Ashtabula County is provided by both Spectrum and Windstream, offering a combination of fiber and full wireless plans. The presence of multiple providers ensures competitive pricing and reduces the risk of service disruptions due to provider outages. For most industrial and commercial users, this represents a low-risk factor, as scalable and reliable network solutions are readily available. Risk is assessed as low.

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

5.3 Risk Factor: Transportation/Logistics

5.3.1 Road/Highway Access

Risk Information: Ohio State Route 11 (SR 11), located one mile from the industrial site, is a north-south freeway running through northeastern Ohio. The freeway provides a direct connection from Ashtabula to cities like Youngstown and East Liverpool. Interstate 90 (I-90), a major east-west corridor, is located just six miles away and runs through Ashtabula County. This interstate links Ashtabula to key destinations such as Cleveland to the west and Buffalo, New York, to the east. Both SR 11 and I-90 are well-maintained, four-lane (or wider) highways that remain open and accessible even during winter months, ensuring year-round road transportation. Risk is assessed as low.

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

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

5.3.2 Rail Access

Risk Information: The 80-acre site has an active rail spur in place that was used previously by Union Carbide. This is connected to the CSX main line just to the west of the parcel. This existing rail infrastructure results in very low risk for rail access.

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

5.3.3 Airport Access

Risk Information: The Northeast Ohio Regional Airport is located 10 miles south of the business center of Ashtabula. Its 5,900 ft asphalt runway and multiple FBOs (fixed-base operators) serve both private and corporate aircraft with AvGas and AvJet, along with airframe and powerplant maintenance and repairs.

Erie International Airport (PCW) is 40 miles to the east offering several non-stops by American Airlines. Cleveland Hopkins International Airport is 70 miles west and provides full domestic and international connections. Risk is assessed as low.

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

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

5.3.4 Water Freight Access

Risk Information: The industrial site benefits from a primary water freight port two miles west. The Kinder Morgan/Pinney Dock is a deep-water port on Lake Erie, offering loading and unloading services for vessels, trucks, and rail via Norfolk Southern and CSX. This well-established infrastructure provides reliable and efficient water freight access, minimizing logistical risks for new developers.

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

5.4 Risk Factor: Social Infrastructure

5.4.1 Healthcare (Local)

Risk Information: Ashtabula is served by two primary hospitals: Ashtabula County Medical Center, a 234-bed facility, and Geneva Medical Center, a 25-bed healthcare option.[41] Emergency, EMT and ambulance services are provided by Community Care Ambulance (CCA) based in Ashtabula. This healthcare infrastructure creates low risk for medical services.

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

[41] https://www.armchealth.org/

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

5.4.2 Education (Schools)

Risk Information: The Ashtabula Area City School District comprises eight schools with an enrollment of approximately 3,050 students, K-12th grade.[42] Higher education facilities in the area include Kent State University, Ashtabula County Technical & Career Campus (A-Tech), Franklin University, and Lake Erie College. Lake Erie College offers Agricultural Economics, Soil Science and Nature Conservancy curriculums. This is a well-developed local education system and presents a very low risk.

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

5.4.3 Local Transportation

Risk Information: Ashtabula County Transportation System provides both scheduled stops and door-to-door services in Ashtabula. Rates are $2.00 for adults, $1.00 for seniors/handicapped, and $0.75 for kids over three. Additionally, there are several private transportation companies, Uber and City Cab offering alternatives to public transportation. This local transportation network yields low risk for workforce mobility.

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

[42] https://www.usnews.com/education/k12/ohio/districts/ashtabula-area-city-110093

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

5.4.4 Public Safety (Local)

Risk Information: Public safety in Ashtabula is managed by multiple agencies, including the Ashtabula City Police Department, the Ashtabula County Sheriff's Office, and the Ohio Office of Public Safety. These agencies provide law enforcement, emergency response, and civil safety services across the city and county.

Crime rates in Ashtabula are generally in line with national averages. The violent crime rate is approximately 1.24 incidents per 1,000 residents, below the national average of 4 per 1,000.[43] Property crime is recorded at 11.86 per 1,000 residents, lower than the national average of 19 per 1,000. With multiple law enforcement agencies providing coverage and crime rates that are not excessively high, public safety risk is considered low.

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

5.4.5 Housing/Cost of Living

Risk Information: Ashtabula offers a cost of living that is notably lower than the national average. The city's cost of living index is 73.5, indicating it is 26.5% less expensive than the U.S. average.[44] Housing costs in Ashtabula are particularly affordable. Housing expenses are 51.6% below the national average, with the median home price approximately 61.3%

[43] https://www.cityofashtabula.com/police-department
[44] https://www.bestplaces.net/cost_of_living/city/ohio/ashtabula

lower than the national median.[45] These favorable living costs result in very low risk for housing and cost of living factors.

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

5.5 Risk Factor: Labor

5.5.1 Workforce

Risk Information: Ashtabula County has a civilian labor force of approximately 42,400 individuals.[46] As of December 2024, the county's unemployment rate stands at 5.6%, which is higher than the national average of 3.8% for the same period. In comparison to neighboring counties, Ashtabula's unemployment rate is higher than those of Lake County (3.2%), Geauga County (3.3%), and Trumbull County (4.0%).[47]

Ashtabula County's higher unemployment rate compared to surrounding counties is primarily due to its reliance on manufacturing and construction industries, which are more vulnerable to market fluctuations and economic downturns. The county's economy has been slower to diversify, while neighboring areas benefit from growth in sectors like healthcare and technology. Additionally, Ashtabula has an older population with a lower labor force participation rate, and its proximity to larger urban centers with more employment opportunities further exacerbate the unemployment gap. These labor market conditions create medium risk for workforce availability.

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

[45] https://www.areavibes.com/ashtabula-oh/cost-of-living/
[46] https://www.ohiolmi.com
[47] https://ohiolmi.com/_docs/LAUS/ranking.pdf

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

5.5.2 Labor Costs

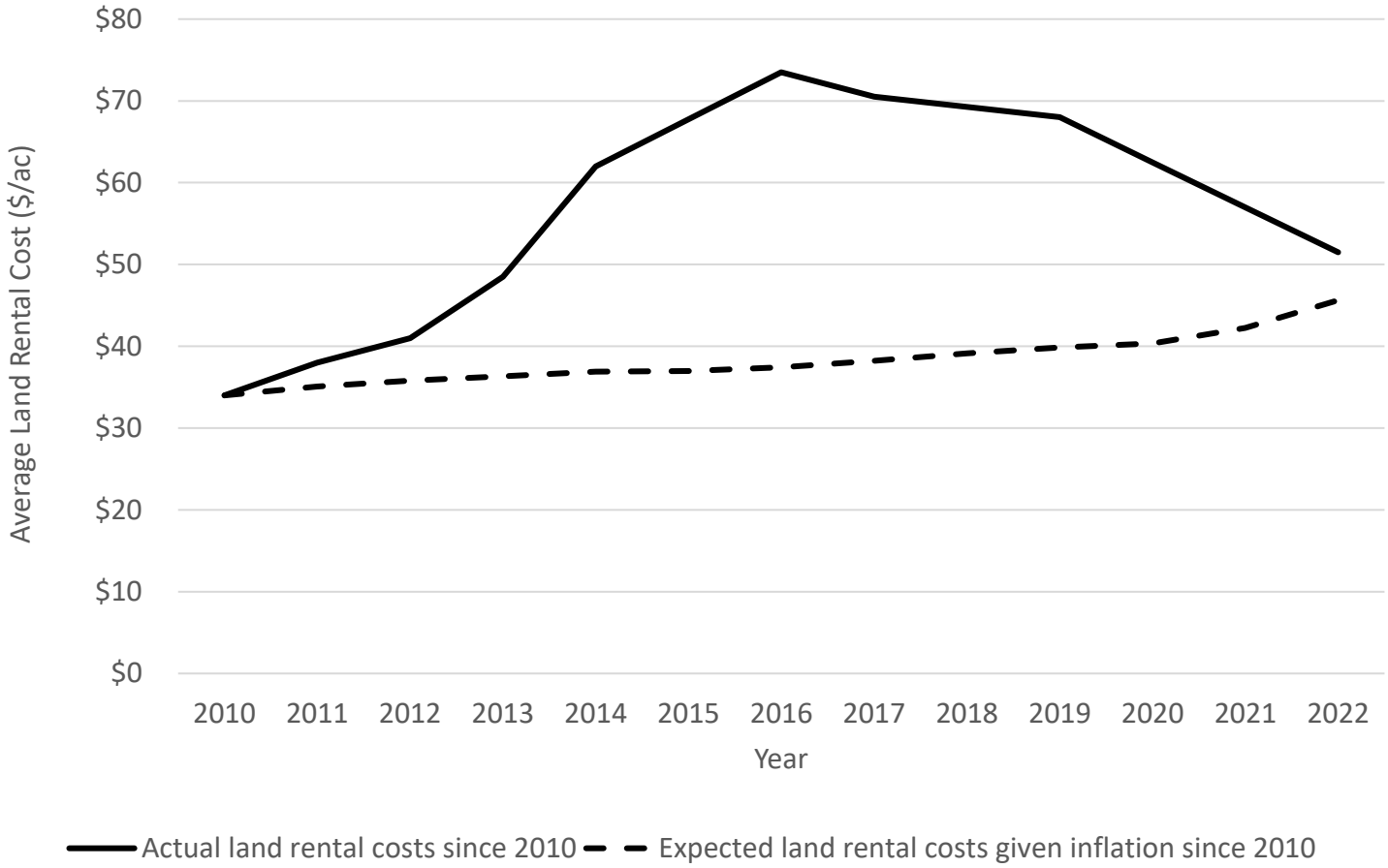
Risk Information: The minimum wage of $10.70 per hour, effective in Ohio as of January 2025, is higher than the federal minimum wage of $7.25 per hour but remains on the lower end of the scale compared to states with higher minimum wage thresholds, such as California or New York. The average annual salary of $48,663 in Ashtabula County, translating to about $23.40 per hour, is slightly lower than the national average. This means that while labor costs in Ashtabula may be more affordable than in many urban centers, they are still competitive within Ohio, where the median household income across the state is around $58,000.[48] Overall, the labor costs in Ashtabula County are favorable for industries that rely on low-to-mid-level wage employees. Risk is assessed as low.

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

[48] https://datausa.io/profile/geo/ashtabula-county-oh

SECTION E: TABLES AND FIGURES

Figure E-1. Actual and Inflationary Agricultural Land Rental Costs in Ashtabula County, 2010-2017[49]



[49] https://ashtabula.osu.edu/sites/ashtabula/files/imce/Ashtabula-LandRentalDecision2018-4.25.pdf; USDA NASS Great Lakes Region Ohio Cash Rent County Estimates series.

Figure E-2. Theoretical Feedstock Supply Curve

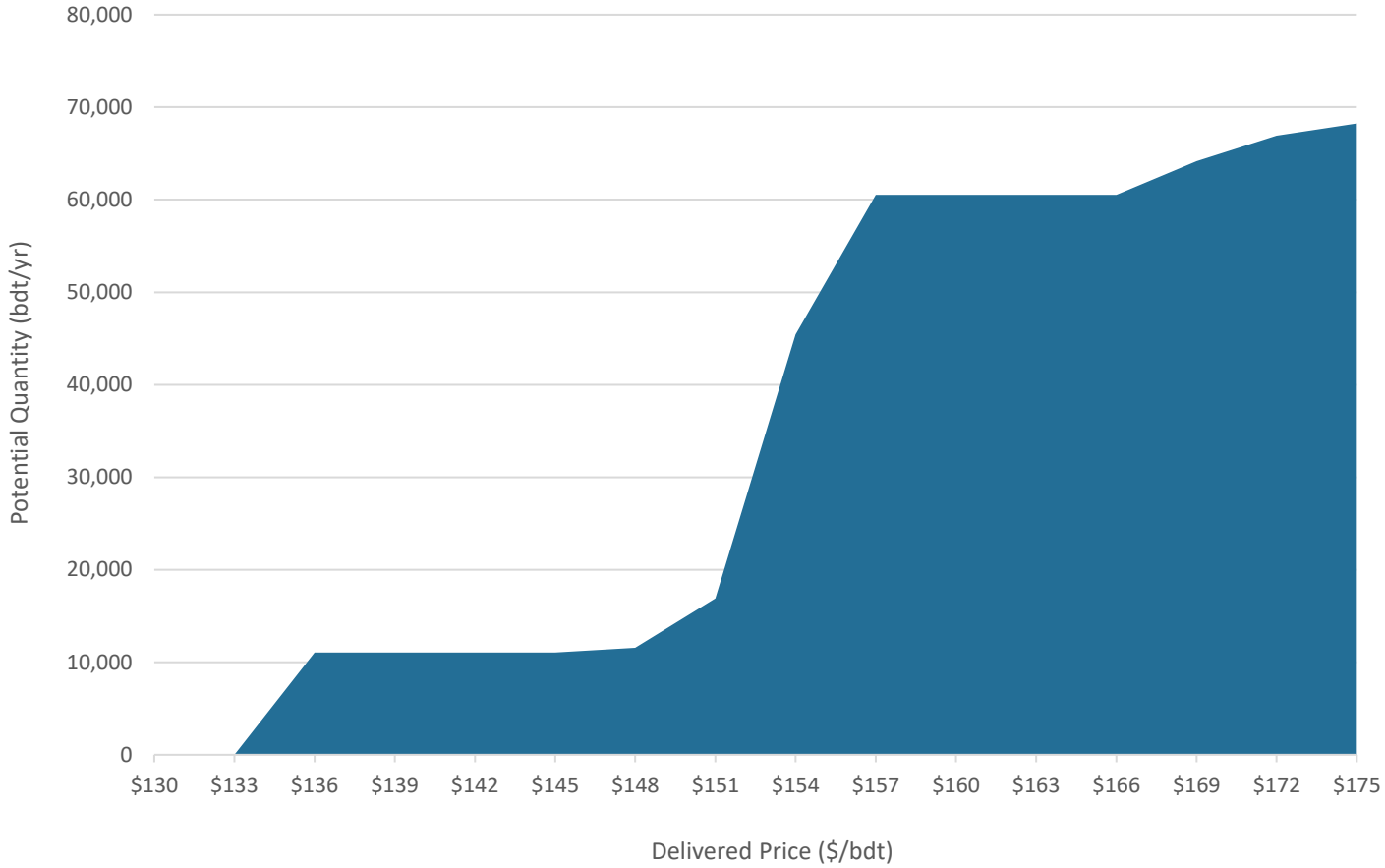


Figure E-3 Comparison of U.S. Midwest PADD 2 and National Average Diesel Prices, 1994-2024

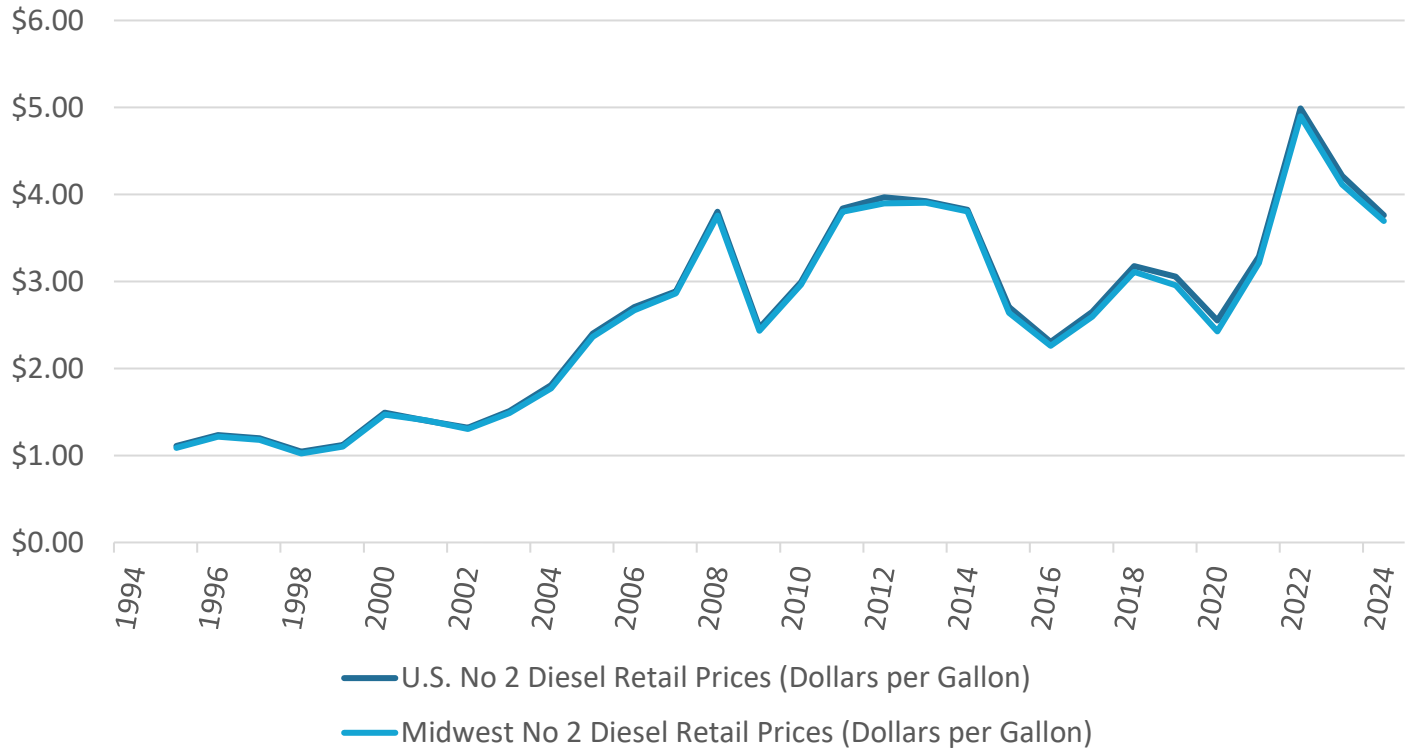


Figure E-4. Acres of Corn Grain Harvested and Yield in Ashtabula County, 1980-2024

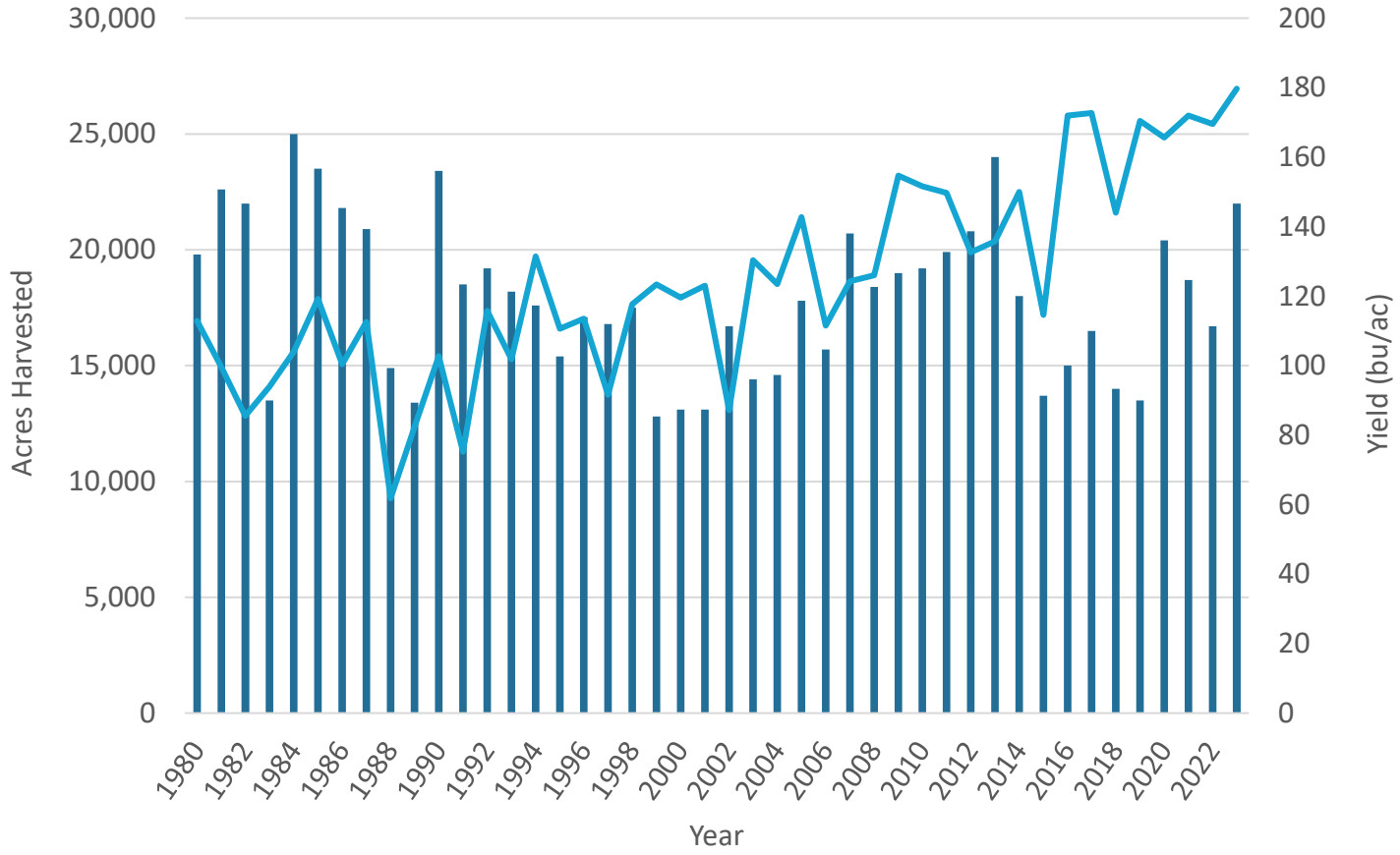


Figure E-5. Location of Ashtabula County within Ohio



Figure E-6. Industrial Site – Ashtabula, Ohio



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