Lincoln County

Biomass to Energy Project

Fatal Flaw Analysis & Concept Feasibility Study

Lincoln County, Montana

June 26, 2026

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Contents

Tables

Figures

Appendices

1 Executive Summary

Lincoln County, Montana, is evaluating development of a biomass-to-energy facility as a means to strengthen the local economy, reduce wildfire fuels and open burning, improve solid-waste management, and generate dependable renewable energy from underused regional resources. The study finds that the County has favorable fundamentals for continued development: approximately 250,000 to 275,000 green tons of woody biomass may be regionally available each year, and a conservative planning estimate indicates that about 337 tons per day could be sustainably directed to a facility. Potential feedstocks include logging residues, forest-thinning material, mill waste, and utility-corridor clearing debris. Municipal solid waste is also available, but its variable composition, processing requirements, emissions controls, and ash-management needs make it a more complex and costly initial fuel source.

Policy and market conditions further support the opportunity. The Master Stewardship Agreement and Good Neighbor Authority provide mechanisms for long-term forest restoration, hazardous-fuels reduction, and biomass recovery, while Libby's "A" Bioeconomy Development Opportunity Zone rating indicates comparatively low feedstock and infrastructure risk. Site screening identified the Port Authority Mill in Libby and the Stoken Rentals property in the Fortine/Eureka area as the most viable locations. The Port Authority Mill ranked highest because of its industrial setting, available land, rail and highway access, water resources, nearby electrical infrastructure, and alignment with redevelopment objectives. Stoken Rentals also offers strong biomass-handling logistics and industrial compatibility. In contrast, the Eureka Landfill has fatal flaws related to constrained land, inadequate access, limited utility capacity, nearby residences, and the substantial cost of electrical interconnection.

The technology review concludes that direct combustion using a grate-based system is the most proven, reliable, and lowest-risk option for clean woody biomass. Fluidized-bed systems may offer fuel flexibility but add operational complexity, while gasification and pyrolysis have less commercial maturity for an application of this scale and feedstock variability. Modular municipal-solid-waste systems are scalable but generally have lower efficiency and higher unit costs. Planning-level estimates indicate capital costs of approximately $28 million for a woody-biomass facility processing about 65,000 tons per year and approximately $56 million for a modular municipal-solid-waste facility processing about 24,000 tons per year. Electricity sales alone are not expected to achieve breakeven; financial feasibility will depend on a combination of viable feedstock-delivery economics, tipping or hauling fees, grants and tax incentives, favorable energy or thermal offtake arrangements, and an appropriate public-private delivery structure.

The recommended path is a phased development strategy. In the near term, Lincoln County should advance a direct-combustion woody-biomass facility at the Port Authority Mill, subject to confirmation of site control, air permitting, interconnection requirements, technology performance, and project financing. Initial operations should rely on clean forest residues and wood waste supported by long-term supply agreements with logging operators, land-management partners, and utility-clearance programs. Municipal-solid-

waste conversion should be evaluated as a later, separate expansion after waste quantities, preprocessing requirements, permitting conditions, markets, and funding are better defined; co-mingled combustion should not be pursued initially because it would materially increase operating and regulatory risk.

Before committing to final design or construction, the County should secure bankable feedstock commitments, complete detailed interconnection and air-quality analyses, confirm reliable water and fire-protection supplies, identify electricity and potential thermal-energy customers, refine capital and operating costs through vendor proposals, and establish a funding and ownership model. Key risks include dependence on federal timber policy and project approvals, seasonal and variable feedstock production, delivered fuel costs, competing biomass uses, utility upgrades, permitting constraints, workforce availability, and public acceptance. With these risks addressed, the project could reduce wildfire hazards and open burning, extend landfill life, lower waste-hauling demands, support grid resilience, create year-round employment, reactivate industrial property, and retain more economic value within Lincoln County. Overall, the study supports continued development of a woody-biomass project at the Port Authority Mill as the County's most practical and lowest-risk opportunity, while preserving flexibility for future municipal-solid-waste integration.

2 Background & Scope

Lincoln County, Montana is a rural county, encompassing approximately 3,675 square miles. It is characterized by mountainous terrain and federal land ownership, with approximately three-quarters of the county within the Kootenai National Forest. The county's population was estimated at approximately 22,184 residents in 2024, reflecting a population increase of more than 12 percent since the 2020 Census, with growth being driven largely by in-migration. Lincoln County operates under Montana's elected county commission form of government, with growth and land use guided by an adopted growth policy and subdivision rules. Development in Lincoln County is largely concentrated near existing communities due to infrastructure constraints and extensive public land ownership.

Over the years, Lincoln County has seen significant decline in overall industry that has consequently negatively impacted its residents. Once a thriving community led by the timber and natural resource industries, regulations imposed since the 1980s have restricted resource extraction, resulting in numerous business closures and subsequent job losses. To combat these issues, Lincoln County is exploring numerous avenues to revitalize the County and return it back to its prosperous state towards the end of last century.

The concept of increasing access to and enhancing the utilization of the available biomass resources within Lincoln County for a power or co-gen operation is not a new concept. Previous studies have been conducted to determine the viability of such an operation, most recently in 2010 via the Porter Bench Energy, LLC Biomass Feasibility Study. These past projects however, were not supported by newly established agreements and policies that have been recently adopted that grant the County access to the required resources necessary.

This feasibility study aims to expand on previous study efforts and further evaluate the development of a biomass-to-energy facility that advances infrastructure supporting a circular-economy model for Lincoln County by converting locally generated forest residues, logging byproducts, and select waste streams into reliable, decentralized renewable energy. The project is motivated by the need to reduce wildfire risk, limit open-burning practices, improve regional air quality, and strengthen long-term economic resilience. Current logging activities utilize slash-pile burning and generate unmanaged residue material accumulation. These practices contribute to regional particulate emissions and increase wildfire fuel loads.

Alternatively, a modern biomass-to-energy system can process these same materials under controlled conditions that can mitigate emissions, while capturing useful heat and power. The facility's purpose is to support forest-health treatments, stabilize feedstock markets, and create a closed-loop system in which waste materials are converted into energy that benefits local communities. This type of infrastructure development lays out the foundation to support a robust regional circular economy and bolster the energy grid during extreme winters.

There are several systems in close proximity to the region of Lincoln County assessed for this feasibility study. These systems are of similar size and capacity as what would be ideal for a waste to energy system developed in Lincoln County.

Additionally, the County is also faced with the challenge of how to handle their Municipal Solid Waste (MSW). MSW was also considered as a feedstock in this study for a potential co-mingled waste to energy facility. MSW was assessed due to limited landfill disposal capacity in Lincoln County, and to attempt to reduce hauling of MSW within the County. The heterogenous nature of MSW makes it more difficult when combining with woody biomass from upfront processing, firing or boiler design, and post-combustion processing of metals for recovery, including ash disposal.

2.1 Project Definition & Objectives

The proposed project is the development of a biomass-to-energy (BTE) facility in Lincoln County, Montana designed to convert locally available woody biomass and select municipal solid waste (MSW) streams into renewable energy. The facility is intended to serve as a core component of the County's long-term solid waste management and forest health strategy by providing a reliable, locally controlled solution for processing residual materials from lumber operations that are currently underutilized or disposed. The primary objective of the project is to establish a sustainable and economically viable energy facility that supports a circular economic framework within Lincoln County. The project aims to improve regional air quality by replacing uncontrolled combustion practices (i.e. slash pile burning) with modern, permitted systems equipped with advanced emissions controls, while also contributing to reductions in wildfire risk through the removal and beneficial use of forest residues.

A key objective is to utilize the County's abundant woody biomass resources, including logging residues, forest-thinning byproducts, and mill waste, which have been identified as a consistent and long-term feedstock supply. A secondary objective is to reduce the dependance on the County's landfill for all MSW disposal to help extend its useful life with the tertiary benefit of potentially mitigating costly MSW hauling prices, particularly between Eureka and Libby, by incorporating MSW combustion systems. Additionally, by generating renewable electricity and potentially supporting combined heat and power (CHP) applications, the facility can contribute to grid reliability, particularly during peak winter demand, while also creating local jobs and supporting industrial redevelopment within the County. The project aligns with regional economic development priorities established by the County's leadership.

2.2 Feedstock Sources

Notable updates to potential feedstock sources, from prior studies conducted, that would support a BTE facility include a recently adopted Master Stewardship Agreement (MSA) (Refer to Master Stewardship Agreement

) between the County and United States Forest Service (USFS), the Good Neighbor Authority (GNA) program between DNRC / USFS / Bureau of Land Management (BLM), and the Bioeconomy Development Zone Risk Rating Report - 11Appendix F.

2.3 Lincoln County / Forest Service Master Service Agreement

An improved benefit to this study versus others conducted in the past, is the newly formed Master Stewardship Agreement (MSA) between Lincoln County and the USFS that establishes a framework for long-term collaboration on forest restoration, wildfire risk reduction, and landscape resiliency projects across 2.29 million acres of the Kootenai National Forest. The agreement prioritizes high-risk Wildland Urban Interface (WUI) areas identified in the 2023 Community Wildfire Protection Plan.

Lincoln County faces significant wildfire threats, with over 530,000 acres identified at risk and 100% of homes exposed to wildfire danger. The county also contains the largest WUI area of any western U.S. County, further highlighting the need for coordinated land management.

Projects under the MSA may include hazardous fuels reduction, watershed and habitat restoration, prescribed fire, road and trail work, noxious weed treatment, and other activities aligned with the Healthy Forest Restoration Act. Each project will be implemented through a Supplemental Project Agreement (SPA), which includes maps, treatment descriptions, financial plans, monitoring requirements, and compliance instructions.

Lincoln County is responsible for coordinating project development, working with the County Firesafe Council, identifying contractors, and serving as the primary liaison. The U.S. Forest Service will provide NEPA compliance, project approval, technical design, and oversight. Both parties will jointly seek funding and collaborate annually to review and prioritize projects.

The agreement includes detailed financial, administrative, and compliance requirements such as record retention, nondiscrimination, drug-free workplace adherence, and property management protocols.

The MSA remains in effect through August 31, 2034, enabling a decade-long partnership to improve forest health, reduce wildfire risk, and support resilient landscapes in Lincoln County. The complete agreement is included in Master Stewardship Agreement

2.4 Good Neighbor Authority

The Good Neighbor Authority (GNA) timber program in Montana is a state-federal partnership that enables the Montana Department of Natural Resources and Conservation (DNRC) to implement forest management and timber harvest projects on federally managed lands. Authorized under the 2014 Farm Bill, GNA allows the state to act on behalf of the U.S. Forest Service and Bureau of Land Management (BLM) to accelerate restoration activities using state contracting and operational capacity.

The primary objective of the GNA timber program is to increase the pace and scale of forest restoration across Montana's predominantly federal forest landscape. Given that a significant portion of the state's forests are federally managed, the program serves as a critical tool to address forest health challenges, wildfire risk, and watershed protection while enhancing interagency collaboration.

2.4.1 Under GNA, Montana DNRC:

- Plans and administers timber sales and restoration projects on federal lands.
- Uses state procurement processes and contractors to execute work.
- Integrates commercial timber harvest with non-commercial treatments such as thinning and fuel reduction.
- Reinvests timber sale revenues into future restoration projects, creating a self-sustaining funding mechanism.

2.4.2 The program delivers multiple strategic outcomes:

- *Accelerated Project Delivery:* Overcomes federal staffing and funding constraints to complete projects more quickly.
- *Wildfire Risk Reduction:* Reduces hazardous fuels and improves defensible space near communities.
- *Improved Forest Health:* Addresses insect, disease, and overstocked forest conditions
- *Economic Impact:* Generates timber supply for Montana's forest products industry and supports rural economies.
- *Cross-Boundary Coordination:* Enables cohesive management across federal, state, and private lands.

Individual GNA projects in the Kootenai National Forest (KNF) have routinely delivered hundreds of acres treated per project, millions of board feet of timber per sale, and hundreds of thousands of dollars per contract. Statewide GNA targets (including KNF) have aimed to treat ~25,000 acres annually in priority areas. Recent statistics, published by DNRC as of May 2026, express the following results of the GNA thus far:

- 298 total projects
    - 79 within KNF
        - 57 of the 79 projects have been within the WUI
    - 111 within Flathead National Forest

Overall, the GNA targets direct, on-the-ground outcomes that aim to protect communities, like Libby and Eureka, while trying to enhance the ecological and economic stability of northwest Montana. This established program will help support any potential BTE facility pursued as an additional means to unlock federal land's biomass capacity as a fuel source.

2.5 Bioeconomy Development Opportunity Zone Rating

The Libby, Montana BDO Zone is rated 'A' (low risk) for bioeconomy plant development, based on a comprehensive assessment of biomass supply chain risks and infrastructure assets. The rating reflects stable long-term feedstock availability, competitive pricing, and robust supply chain resilience, with some notable limitations and risks.

2.5.1 Feedstock Availability and Pricing

- *Annual Woody Biomass Generation:* Estimated at 790,392 green tons/year (gt/yr), with 450,819 gt/yr Sawmill Residuals, 273,088 gt/yr Forest Residuals, and 66,485 gt/yr Pulpwood.

- *Functionally Available Feedstock:* Approximately 256,479 gt/yr is available for new bio-based plant development, primarily from Forest Residuals and Pulpwood.

- *Feedstock Prices:*
  - Forest Residuals: $30–$35/gt
  - Pulpwood: $25–$35/gt
  - Sawmill residuals: $15--$55/gt (varies by category)

2.5.2 Supply Chain and Market Dynamics

- *Strengths:*
  - Large quantities of Forest Residuals and Pulpwood are underutilized, presenting strong opportunities for new market entrants.
  - Reliable anchor supply and available labor market.
  - Few competing markets for Forest Residuals and Pulpwood.

- *Limitations:*
  - Sawmill Residuals are largely committed to existing markets, with limited access for new entrants.
  - Significant feedstock is derived from National Forest Service land, subject to regulatory and LCFS (Low Carbon Fuel Standard) limitations.
  - Increasing fuel prices and externalities (wildfires, weather events) impact supply chain costs and reliability.

2.5.3 Risk Assessment

- *Overall Risk Rating:* 'A' (low risk), with a BDO Zone score of 15.18 out of 100.
- *Risk Indicators:* 51 risk indicators were assessed, including supplier risk, competitor risk, and supply chain risk. Most risks are mitigated by existing infrastructure, market conditions, and potential for reasonable mitigation measures.
- *Key Risks:*
  - Strong demand and competition for Sawmill Residuals.

- External risks such as slow lumber markets, wildfires, and climate trends.
- LCFS limitations for fiber from federal lands, restricting certain biofuel commercialization.

2.5.4 Infrastructure Assets

- *Physical Infrastructure:* Positively rated, with good access to land, water, sewage, landfill, and electrical services. Natural gas is not locally available.
- *Logistics:* Ample highway, rail, and airport access. Road infrastructure is aged but maintained.
- *Average Infrastructure Score:* 3 out of 10 (supplementing the low risk designation).

2.5.5 Opportunities

- *Market Development:* Forest Residuals and Pulpwood offer strong levers for new bioeconomy plant development due to low current utilization and supportive forest management objectives.

- *Labor and Supply Chain:* The forestry labor market is capable of scaling, and supply chain components can adapt with investment.

  The Libby, Montana BDO Zone presents a robust, low-risk environment for bioeconomy plant development, with significant opportunities in underutilized Forest Residuals and Pulpwood. While Sawmill Residuals are largely committed, the region's infrastructure, labor market, and supply chain resilience support new investment. Stakeholders should consider regulatory and external risks, but the overall outlook is positive for sustainable bioeconomy growth in Libby. The full report can be seen in 11Appendix F.

3 Site Screening

The Porter Bench Energy, LLC (PBE) Biomass Feasibility Study (Porter Bench Energy, LLC Biomass Feasibility Study, Volume 2

- Bonner Site
- Ksanka/Fortine Site
- Troy/Chapel Cedar Site
- Stoltze Site – Whitefish/Columbia Falls.

The Bonner, Ksanka/Fortine, Troy/Chapel Cedar, and Stoltze (Glacier Park International) sites identified in the Porter Bench Energy biomass assessment were not carried forward for the Lincoln County feasibility study primarily due to geographic and economic considerations. These sites are located outside or on the periphery of Lincoln County and, in most cases, are beyond a practical hauling distance for biomass fuel supply into a Lincoln County-based facility. The original report evaluates biomass availability within 40- and 70-mile working radii around each site, reflecting typical economic transport limitations.

Alternatively, this assessment reviewed four sites identified jointly by both the County and Lincoln County Port Authority. The locations below were identified to develop a biomass to energy facility.

- Port Authority Mill site (Libby)
- Stokken Logging Mill Site (Fortine)
- Lincoln County Landfill – Eureka
- Lincoln County Landfill - Libby

3.1 Port Authority Mill

The proposed project area lies within the Kootenai Business Park, a 400-acre industrial site in Libby, Montana, owned and managed by the Lincoln County Port Authority (LCPA). The property formerly operated as the Stimson Lumber Company mill, a major regional timber-processing center until its closure in 2002, following decades of lumber and plywood production. During part of its tenure, the mill conducted onsite wood-treating operations, which lead to long-term contamination and a Superfund designation. Additionally, the site later became part of the Libby Asbestos Superfund as Operable Unit 5 (OU5). EPA issued a partial deletion of OU5 from the National Priorities List in August 2024 indicating hazard mitigation and readiness for redevelopment. The presence of existing infrastructure, cleared development zones, and available utility corridors make the property suitable for industrial, biomass conversion operations.

3.1.1 Land Use & Zoning Compatibility

Industrial/heavy commercial

- Zoning designation: City of Libby Industrial District (Title 17, Ch. 17.28) - 2024 future land use map.

- Permitted use pathway: Biomass-to-energy operational activities fall under approved land uses within Industrial District zoned parcels, §17.28.010 “Uses generally,” with any special elements reviewed via Ch. 17.10 (CUP).
- Parameters (setbacks, height, projections): Ch. 17.28 and Ch. 17.32 - height exceptions for stacks/towers; yard projection limits; and fence/wall rules.
- Overlays/constraints: OU5 Superfund operation and maintenance plan must be integrated into design and permitting.

3.1.2 Parcel

The proposed parcel is approximately 120 acres of immediately developable industrial land zoned for heavy industrial uses; shown in Figure 1.

Figure 1: Existing Port Authority Mill Site

3.1.3 Setbacks & Sensitive Receptors

Current business park occupants include logistics, fabrication, communications technology, recreation, and parcel-delivery companies (FedEx, UPS, Nomad Global Communications Solutions, Clark’s Courts). The business park is situated in a dedicated industrial zone with adjacent industrial and commercial operations. No residential neighborhoods directly adjacent to the central industrial parcels.

- Large acreage provides internal buffering between plant operations and parcel boundaries.

    - Hospital is approximately 3300ft. from the proposed operational area
    - Closest residence is approximately 1000’ from the proposed operational area
- Institutional controls put in place by EPA help manage long-term land-use restrictions while supporting industrial redevelopment.

3.1.4 Access & Logistics

The site has a direct connection to a 5,000-foot lead track that ties into the BNSF Railway mainline, enabling potential inbound and outbound shipment of biomass feedstock, ash, and equipment. The site has a BNSF Certified Site designation, which supports rail-service feasibility and engineering readiness for potential industrial tenants. Rail rehabilitation is actively supported by a $750,000 U.S. Economic Development Administration grant, with the Port Authority prioritizing rail-spur reactivation intended to enhance freight capacity

The parcel is located at the junction of State Highway 37 and U.S. Highway 2, providing direct truck haul routes for biomass material coming from regional forest operations and sawmills. The former mill layout and current business-park design incorporate industrial truck circulation patterns, including private heavy-duty access roads and staging areas for rail and warehouse operations.

- Rail and highway adjacency lowers transport costs for feedstock supply chains. Possible receiving for regional municipalities that need landfill capacity.
- Industrial zoning and available parcels support sizable processing buildings, storage yards, conveyors, and thermal or electrical generation facilities.
- Existing cleared industrial footprint reduces site preparation expenses compared to greenfield alternatives

3.1.5 Utilities Availability

Upgraded water-main systems have been installed within areas impacted historically by contamination plumes. There is an onsite diversion channel with pond storage – water rights to Libby creek for 11 MG/day. Additionally, there is a 25 MW Flathead Electric Sub Station, stormwater storage lagoons, existing boiler building, feedstock push walls, and conveyor infrastructure (Figure 2).

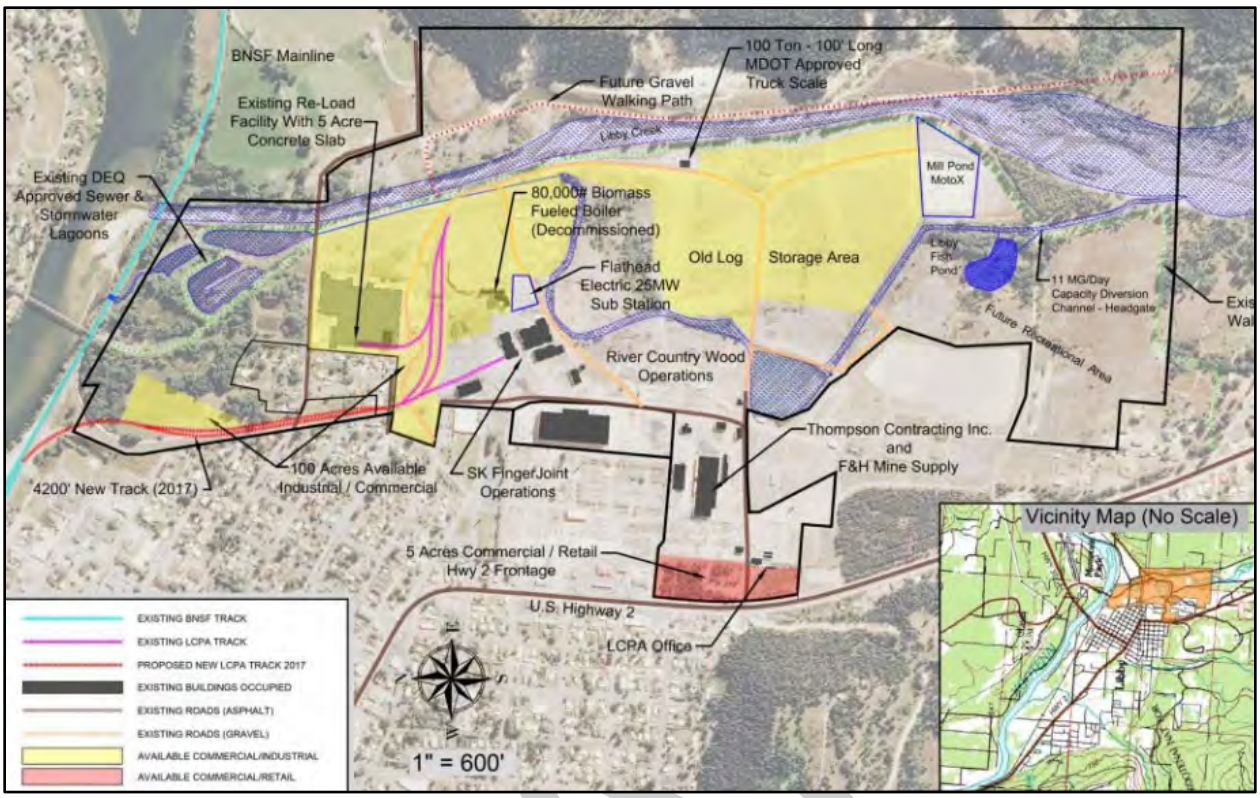

Figure 2: Port Authority Land & Surrounding Area: Montana Department of Environmental Quality (DEQ), 2017. *December 2017 Technical Advisory Team Presentation: Libby Asbestos Site*, Libby, Montana Superfund Program

3.1.6 Environmental Constraints

Extensive cleanup has been conducted on parcel, including the removal of asbestos-contaminated material. Remaining environmental controls include;

- Institutional land-use controls
- Long-term monitoring under EPA operation and maintenance (O&M) inspections

These constraints do not prohibit industrial development but require compliance with the land-use framework established by EPA. EPA continues to perform O&M inspections and monitoring under the Superfund program. Environmental permitting for a biomass facility will require coordination with Department Environmental Quality and EPA to align with OU5's O&M plan.

Separate from zoning, the site is subject to institutional controls established under EPA's Libby Asbestos Operable Unit 5 program. The Institutional Control Implementation and Assurance Plan (2016) and OU5 Operations & Maintenance Plan (2018) describe land-use restrictions, ground-disturbance protocols, soil management, and notification requirements for any proposed development.

3.1.7 Hazard Constraints

The property formerly contained:

- Asbestos contamination from regional mining and mill operations
- Wood-treating chemical residues (1946–1969)

These hazards have been mitigated through EPA cleanup.

Remaining constraints include:

- Institutional controls that may restrict excavation depths or soil disturbance in certain areas
- Requirement to coordinate placement of structures or utilities with documented contamination boundaries

These constraints can typically be engineered around with proper geotechnical and civil design

3.1.8 Community Context

The Libby region has experienced decades of economic contraction associated with the decline of timber and mineral industry production. However, the Kootenai River Development Council is actively focused on economic diversification, industrial redevelopment, and new job creation. There has been recent private investment and new business development in the Kootenai Business Park (e.g., hotels, logistics firms, recreational facilities). The Kootenai Business Park is within a county-adopted Targeted Economic Development District (TEDD) - a financing tool to support industrial infrastructure development. Community development goals prioritize:

- Utilizing remediated Superfund lands for productive economic activity
- Renewable-resource-based industry attraction
- Infrastructure improvements to support long-term job growth

A biomass-to-energy facility aligns well with local objectives by leveraging abundant forest resources, strengthening resilience in the wood-products sector, mitigating air quality issues from slash burning and providing year-round employment.

3.2 Stoken Rentals Site

The site is owned by Stoken Rental LLP. The region has historically had timber and logging related activities in the Fortine–Eureka corridor. The region has significant tree mortality within 70 miles.

3.2.1 Land Use & Zoning Compatibility

The site lies in unincorporated Lincoln County near Fortine, Montana. This region of the county Land use parameters are primarily governed through subdivision review.

3.2.2 Parcel

Formerly a mill, owned and operated by Plumb Creek, the property fronts US-93, allowing formation of segregated inbound/outbound truck lanes, onsite scale pads, and open storage areas for roundwood, residues, or chips. The large tract size can support heavy duty truck turning radius, pile spacing, and aisle widths typical for biomass

operations. The parcel acreage is ~221.53 acres (~1,560 sf building; “office building” land use); shown in Figure 3.

Figure 3: Stoken Rentals Site Aerial

The site falls within the Trego/Fortine/Stryker (TFS) Fire District service area; water supply for firefighting dependent upon onsite tanks/ponds or private well capacity.

3.2.3 Setbacks

- Fortine School (PK-8) is approximately ~1.2 miles from the site.\
- Fortine CDP population was 317 (2020), with dispersed rural residential occupied dwellings within 0.5–1.0 mile
- Setback basis. In the absence of countywide industrial yard setbacks, use:
  - MDT approach and sight-triangle standards along US-93 (driveway spacing, throat length), and
  - Fire code pile separation/clearances and DEQ sanitation separations (e.g., from wells/septic

3.2.4 Access & logistics

Fortine is located on Highway 93, midway between Whitefish and Eureka. Historically, the area supported multiple sawmills, indicating previously established haul routes for logs and timber sales. The site fronts U.S. Highway 93, the region’s primary freight corridor between Whitefish and Eureka/Canadian border. Any new or modified approaches would require Montana Department of Transportation (MDT) Approach Permit review. The parcel supports truck queues, two-way haul roads, and emergency

egress lanes. Final design should align with MDT approach geometry and county emergency access expectations.

3.2.5 Utilities

Water at the site is currently accessed via a well located on the north side of the existing shop. The previous mill operator, Plumb Creek, also utilized an onsite storage pond for fire suppression with supplied water from Deep Creek on the northern boundary of the property; property transfer included water rights associated with the Plumb Creek. Electrical service will present a constraint, as a grid tie-in is expected to be challenging and will require further coordination with Lincoln Electric. Line-voltage upgrades and installation of a substation may be necessary, and because nearby residences cannot absorb the full amount of residual power generated, an onsite operational load will likely be required. Power transmission lines with sufficient capacity are accessible on both sides of the adjacent highway, providing potential connection options. A further transmission and distribution study, conducted by Lincoln Electric Co-op, further detailing the needs of the site is included in Lincoln Electric Co-op Transmission and Distribution Study.

3.2.6 Environmental Constraints

The site has been cleared of any EPA/DEQ environmental restrictions prior to its sale in 2011 Stoken Rentals LLC. Fortine lies in the Fortine Creek valley, which flows to the Tobacco River/Kootenai Reservoir system. The parcel is contiguous to the creek system which will increase the need for stormwater controls, runoff management, and sanitation setbacks to protect groundwater/surface water from contamination.

3.2.7 Hazard Constraints

The site is within a rural fire district (Trego/Fortine/Stryker). Biomass operations must address pile management, spark control, onsite water supply, and defensible space consistent with local fire guidance.

US-93 is a high-speed corridor. Any queuing, turning movements, and load securement procedures require MDT-compliant access geometry and on-site stacking to avoid any queuing overflow onto the highway corridor. No Superfund or special institutional controls identified for this site. Standard stormwater pollution prevention and spill response plans are still required during construction and operations.

3.2.8 Community Context

Fortine MT population 317 (2020); on US-93, ~11 miles SE of Eureka and ~40 miles NW of Whitefish. Historical economic base includes timber and rural services. Fortine School serves PK-8 at 358 Meadow Creek Rd with groundwater reliance, reflecting the need for best management practice for dust and stormwater controls during any biomass handling. The Porter Bench study implies there is no explicit community opposition or concerns.

3.3 Libby Landfill

The Libby Landfill is the primary municipal solid waste disposal facility for Lincoln County and is owned and operated by Lincoln County Solid Waste. The facility is located at 2501 Pipe Creek Road near the City of Libby. Libby Landfill accepts municipal solid waste, construction and demolition debris, yard waste, and any special waste in accordance with county regulations and Montana Department of Environmental Quality (DEQ) requirements. The existing landfill footprint is projected to reach permitted capacity by approximately 2027, which prompted Lincoln County to implement a southwestward expansion of the site. The expansion, which was recently completed in late 2025, will extend the landfill's operational life, however it is only anticipated to increase its functional capacity by ~20 years, with no additional access on the current site for further expansions.

Waste arrives both in uncompacted roll-offs and via haulers using compactor trucks on remote or private routes. Wood waste is periodically buried on site with on-site handling including an Air Curtain Burner (ACB) and chipper.

3.3.1 Land Use & Zoning Compatibility

Lincoln County Planning Department oversees local land-use policy, subdivision regulations, zoning records, and development review. A biomass-to-energy facility would need to conform to county zoning regulations for industrial or waste-processing activities, with additional review under solid-waste and air-quality permitting; a Conditional Use Permit (CUP) could be applicable for this future project.

3.3.2 Parcel

The Libby Landfill is located at 2501 Pipe Creek Road, Libby, MT 59923. The landfill operates a biomass receiving and processing operation – outlined in green. This would be the proposed location for a biomass to energy facility. The area identified for the proposed biomass to energy facility is approximately 13 acres. Existing operations use this area for woody waste receiving and processing. This operation would need to remain intact to supplement the landfill operations until the proposed biomass to energy facility is installed. Landfill site aerial shown in Figure 4.

Figure 4: Lincoln County Landfill, Libby - Operational Areas

3.3.3 Setbacks

Landfill expansion documentation references that remaining acreage outside the 14.3 active acres would stay undisturbed, which functions as a buffer zone for environmental protection. Setbacks must comply with Lincoln County subdivision regulations and Montana DEQ siting requirements for solid-waste-related facilities. A biomass facility would need buffer distances from landfill cells and public right-of-way per county and state permitting requirements.

3.3.4 Access & logistics

The landfill is accessed from Pipe Creek Road via Libby Landfill Road. County solid-waste operations emphasize controlled entry and transport safety to ensure secure loads, thus indicating established logistics protocols suitable for truck traffic.

The landfill operates Monday–Saturday, 8:00 AM to 5:30 PM (closed Sundays & holidays), providing predictable access windows for feedstock delivery and operations. Existing heavy-vehicle infrastructure supports frequent truck traffic and material movement—an advantage for biomass feedstock handling.

3.3.5 Utilities

A biomass energy project would require several utility upgrades including but not limited to three-phase power, water supply, and fire suppression storage.

3.3.6 Environmental Constraints

The landfill manages Group II, III, and IV waste streams and enforces asbestos handling and demolition-debris protocols, requires material management plans and emergency response plans that will need to find alignment with the proposed co-located energy facility operations. As a regulated MSW facility, the site must comply with DEQ requirements for groundwater and surface water protection, including setbacks from wells and water bodies, along with stormwater and floodplain controls. Air quality rules also govern activities like burning, dust generation, and any expansion or change in operations would trigger a MEPA environmental review.

3.3.7 Hazard Constraints

Landfill operations involve regulated waste streams including scrap metal, used appliances, concrete, automotive batteries, and other materials with potential hazardous properties. Waste types handled include Group II, III, and IV wastes, which may include industrial and construction materials requiring unique management. Hazard considerations include fire hazards from biomass storage, co-location risks with existing waste types, and potential need for enhanced emergency response planning.

3.3.8 Community Context

The Lincoln County landfill is a central county facility serving Libby, Troy, Eureka, and other various rural communities within the County. Community engagement and transparent communication will be essential. A biomass facility may be positively received if it reduces future landfill loading, supports local energy goals, mitigates open burning, and provides economic benefits**.**

3.4 Eureka Landfill

The Eureka region is a historically timber-dependent area that has undergone industry contraction. Despite this decline, the Porter Bench Biomass Study identifies the area as biomass-rich, with potential for a biomass power facility if supply certainty can be secured. Eureka Landfill is a Class III landfill where nothing is buried. Concrete is received, and wood waste is burnt onsite, as needed. MSW is transferred to the Libby landfill for final deposition. The site contains Lincoln County Public Works buildings, sand and gravel pits, leased land, an old airport landing strip, and MSW/woody biomass receiving area.

3.4.1 Land Use & Zoning Compatibility

Lincoln County Planning administers land-use policy, subdivision and floodplain regulations, and development reviews for Eureka and the surrounding unincorporated

communities. Zoning and regulatory guidance should be coordinated through the Planning Department and the County's adopted regulations and growth policy.

Parcel

The Lincoln County landfill in Eureka, MT, is located at 401 Airport Road, Eureka, MT, 59917, and is owned and operated by Lincoln County. The site serves the northern portion of Lincoln County. The Eureka Landfill site presents several constraints that limit its viability for development of a biomass or waste-to-energy facility. Available land area is limited due to existing uses, including leased parcels, a drainage pond, public works road department and material storage (sand/gravel pit) and waste transfer operations, which reduce the flexibility needed for facility siting and expanded activities. These constraints can be seen in Figure 5.

Figure 5: County Land Overview – Eureka

3.4.2 Setbacks

Applicable setbacks are primarily governed by Montana DEQ solid-waste regulations, supplemented by county land-use standards and site-specific conditions. Development and landfill operational areas must maintain minimum separation distances from surface waters and springs and drinking water wells to protect groundwater and public health. The site is surrounded by nearby residential uses, increasing potential concerns related to noise, traffic, and emissions.

A minimum setback from property boundaries applies to waste-management components, with larger buffers often required through the landfill's DEQ-approved operating plan, along with internal buffers for access, fire safety, and stormwater management. Any buildings or infrastructure associated with onsite development must also comply with Lincoln County zoning setbacks from public roads and property lines, in addition to the DEQ environmental buffers dictated in DEQ license approvals.

3.4.3 Access & logistics

The Eureka Landfill operates at 653 Airport Road with posted hours Mon–Fri 8:00 AM–5:30 PM; Sat 9:00 AM–5:00 PM (closed Sundays & holidays). The access road into the Eureka Landfill is low capacity and structurally failing. New construction of access road would be required. Road access is constrained, ingress and egress is a two-way corridor with consistent traffic flow and limited capacity for heavy truck movement.

3.4.4 Utilities

Utility availability at the Lincoln County Landfill in Eureka is limited. Water service at the site is provided by an existing onsite well, which supports current landfill operations. Electrical service is more restrictive; discussions with the local electric utility provider indicate that there are no high-capacity transmission lines near the landfill. As a result, the existing local grid cannot accommodate substantial additional electrical load without infrastructure upgrades. Generating power at this site would require the installation of new transmission lines routed around the town of Eureka to connect to existing transmission lines to feed the electric grid. The capital consideration for new transmissions lines is significant and would require substantial coordination through planning and permitting. These utility limitations represent a fatal flaw at this site; see Appendix B.

3.4.5 Environmental Constraints

As a permitted municipal solid waste facility regulated by the Montana Department of Environmental Quality (DEQ), landfill activities and associated development are subject to groundwater and surface-water protection requirements, including required separation distances from drinking water wells, springs, and surface waters to prevent contamination. The site must also manage stormwater and runoff controls to protect nearby drainage features and comply with floodplain avoidance standards where applicable. Air quality constraints apply to activities such as open burning of wood waste and dust-generating operations. Any expansion or significant change in use at the landfill

could trigger environmental review under the Montana Environmental Policy Act (MEPA), requiring analysis of potential impacts from new operations. There are residences located contiguous to the Eureka Landfill boundary, which represents a significant hurdle during environmental review.

3.4.6 Hazard Constraints

As an active municipal solid waste facility, the site presents potential risks associated with landfill gas generation, which requires monitoring. Ground stability and settlement can also be key constraints. Lincoln County uses the site for waste receiving and transfer operations, there is land leased to private entities, and Lincoln County operates facilities on-site supporting County road maintenance. These hazard considerations necessitate careful site planning, engineering controls, and regulatory coordination before any development project proceeds.

3.4.7 Community Context

Eureka is one of Lincoln County's three landfill locations managed by the county Solid Waste program, with posted rules, hours, and contacts supporting transparent operations. Planning and permitting engagement is coordinated through Lincoln County Planning and will require public-facing resources to facilitate early community stakeholder engagement. This site provides residents of Eureka and surrounding rural areas with offtake for MSW, concrete, and wood waste.

3.5 Site Decision Matrix

To support the identification of a preferred site location a site decision matrix was developed to provide a structured basis for comparing candidate sites. The decision matrix evaluates each site against a defined set of criteria that are critical to the successful siting, permitting, construction, and long-term operation of a Waste to Energy (WTE) facility. Each criterion is assigned a weighting factor to reflect its relative importance to overall project feasibility, allowing higher priority considerations to have a greater influence on final site rankings. See Table 1.

High weight criteria focus on core operational requirements and cost drivers for a waste facility. Proximity to feedstock (20 points) and interconnection capacity (20 points) are weighted most heavily, reflecting the fundamental need for a reliable waste supply and the ability to export generated power to the electrical grid. Access to major transportation routes (15 points) is also a key consideration, as efficient truck ingress and egress directly affects operating and fuel costs. Parcel characteristics (14 points), including size, shape, topography, easements, and expansion flexibility, are similarly highlighted to ensure the site can accommodate the required infrastructure, potential future expansion.

Moderate weighting is assigned to criteria that affect constructability, permitting risk, and community compatibility. Zoning and permitting compatibility (10 points) evaluates local land use designations, and anticipated approval pathways. Adequate water supply (8 points) is necessary for boiler makeup, cooling, and fire protection, while proximity to sensitive receptors (8 points) considers nearby residences, schools, hospitals, and other

land uses that could be impacted by noise, traffic, or air emissions. Stormwater infrastructure (5 points), while still important, is assigned a lower weighting, as stormwater challenges can often be mitigated through engineered solutions provided sufficient land and regulatory flexibility exist.

A rating system from 1 to 4 (1 being lowest and 4 being the highest) was then applied by County stakeholders and consulting engineers to determine an overall score for each identified site.

Table 1: Site Decision Matrix Scoring and Weightage

		Libby Landfill		Port Authority Mill		Eureka Landfill		Stoken Rentals	
Criteria	**Weightage**	*Rating*	***Total***	*Rating*	***Total***	*Rating*	***Total***	*Rating*	***Total***
Proximity to feedstock	20	2	**10**	3	**15**	1.9	**9.7**	2	**10**
Access to major transportation routes	15	2.5	**9.4**	4	**15**	2.5	**9.4**	4	**15**
Interconnection capacity	20	1	**5**	4	**20**	1.0	**5.0**	4	**20**
Available water supply	8	2	**4**	4	**8**	2.0	**4.0**	4	**8**
Stormwater infrastructure	5	1.5	**1.9**	4	**5**	1.5	**1.9**	3	**3.8**
Zoning/permitting compatibility	10	3	**7.5**	4	**10**	3.0	**7.5**	4	**10**
Parcel	14	1	**3.5**	4	**14**	1.0	**3.5**	4	**14**
Proximity to sensitive receptor	8	4	**8**	3	**6**	4.0	**8.0**	4	**8**
Total	100	17	**49.3**	30	**93.0**	16.9	**48.9**	29	**88.8**

As shown in Table 1, the most applicable site(s) for a future WTE facility were the Port Authority Mill site in Libby and the Stoken Rentals properties. The key differentiators for these sites that make them well suited for any future installation is ultimately their previous history with prior logging and mill operations. Both sites have dedicated access routes for large vehicular traffic, cleared areas for the management of substantial quantities of biomass, are located in close proximity to current and future logging / wildland urban interface operations, and in the case of the Port Authority site in Libby, have direct access to the Kootenai River, BNSF railroad, and electrical substation.

4 Feedstock Assessment & Logistics

4.1 Regional Biomass

Lincoln County, Montana has a large supply of woody biomass that could support an operation of a woody biomass-to-energy facility. A 2023 assessment by the National Renewable Energy Laboratory (NREL) - 11Appendix H, estimates that 250,000 to 275,000 green tons per year of small-diameter trees, slash, and other forest residues are available within an economical hauling distance, and much of this material currently has no commercial use. Forest condition data presented in the Counties on Fire report (Counties on Fire) show that the Kootenai National Forest experiences very high annual tree mortality, with more than 360 million board feet of wood dying each year, much of which becomes hazardous fuel in the Wildland-Urban Interface. Minimal thinning and fuel-reduction programs by federal, state, and private landowners are increasing the amount of this material over time, which could indicate that sufficient biomass supply is likely long-term. These estimates reflect that Lincoln County has enough reliable forest-based feedstock from logging/restoration operations to support continuous feedstock supply of a biomass energy facility for the foreseeable future.

These assessments have clearly established that biomass exists at the regional scale, however, development of a biomass-to-energy facility also depends on, project-specific feedstock delivery. Regional logging companies have been engaged directly and have expressed support for a biomass energy project, including a willingness to supply forest residues, slash, and small-diameter material generated through ongoing operations (Pledges of Support). Information from these engagements is summarized below and offers some assurances that available biomass could be contracted for delivery to a local facility. In addition, utility line-clearance vegetation identified under Forest Service master stewardship agreements represents a consistent and currently underutilized feedstock stream; utility managers indicate that most woody debris from these activities is presently dumped, burned, or left on site. Establishing memoranda of understanding (MOUs), letters of intent, or verbal supply agreements with logging operators and utility partners can be an effective tool to confirm that feedstock materials can and will be delivered to the site in quantities consistent with the processing capacity design parameters. These early commitments would significantly reduce feedstock risk and strengthen the overall feasibility of the biomass-to-energy project.

4.2 Lincoln County Waste

The Libby landfill, is Lincoln County's only Class II landfill, where municipal solid waste can be buried. According to Lincoln County records, Libby landfill also accepts waste from surrounding counties and inbound volumes are estimated in cubic yards. Volume estimates are converted to municipal solid waste (MSW) tonnage using the Montana DEQ's conversion factor with an assumed compaction allowance as shown in Table 2.

Table 2: Lincoln County Landfill (Libby) - Historical Tonnage Estimates

Year	Survey (yd3)	MSW (yd3)	MSW (ton)
2020	42,205	27,600	14,490
2021	51,617	33,700	17,693
2022	49,561	24,781	13.010
2023	50,304	25,655	13,469
2024	37,200	20,088	16,070
2025	48,721	30,207	24,166

Material arrives both in uncompacted roll-offs and via compactor trucks from remote or private routes. Wood is received and processed through an Air Curtain Burner (ACB) or a chipper. Processed wood waste volumes are identified in Table 3.

Table 3: Libby Landfill Wood Tonnage Received.

Year	Location	Wood (tons)	Total (Ton)
2020	Libby	1800	**2,730**
	Eureka	600	
	Troy	330	
2021	Libby	2100	**3,150**
	Eureka	600	
	Troy	450	
2022	Libby	4290	**5,190**
	Eureka	600	
	Troy	300	
2023	Libby	4500	**5,550**
	Eureka	750	
	Troy	300	
2024	Libby	4275	**6,375**
	Eureka	1800	
	Troy	300	
2025	Libby	3252	**5,292**

Year	Location	Wood (tons)	Total (Ton)
	Eureka	750	
	Troy	1290	

The Libby Landfill recently expanded with its first lined cell, now approved for use and providing an estimated 22 years of capacity, while the existing cell is expected to reach full capacity in 2026.

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5 Managed Feedstock Estimate

Lincoln County has approximately 20 logging outfitters currently operating within the county. These operations generate biomass residues (slash, tops, and unmerchantable material) as a byproduct of commercial timber harvesting. Similar residuals are generated via Wildland–Urban Interface (WUI) treatments, private property management, and utility corridor (powerline) clearing activities. This residual biomass is typically managed through piling and burning in place.

From conducted interviews with local operators and regional stakeholders, logging operations in Lincoln County can be broadly categorized into small and large-scale producers:

- 15 small logging operators, each generating approximately 25–50 tons per day of biomass waste
- 5 large logging operations, each generating approximately 60–100 tons per day of biomass waste

Using conservative, average assumptions for daily waste generation, total theoretical, gross biomass availability from managed logging operations alone is estimated as follows:

Small operators:

- 15 operators × ~37.5 tons/day ≈ 563 tons/day

Large operators:

- 5 operators × ~80 tons/day ≈ 400 tons/day

Total

- Total gross biomass generation: ~960 tons/day

Supply Allocation and Participation Assumptions[1]:

To reflect real-world constraints and avoid over-reliance on any single facility, a 50% supply allocation safety factor is applied to the gross biomass estimate. This assumes that only half of the total regionally available biomass would reasonably be directed to the proposed incineration facility, with the remainder assumed to continue flowing to competing end uses, including the incumbent disposal methods.

- Gross biomass: ~960 tons/day
- Allocated to proposed facility (50%): ~480 tons/day

Recognizing that not all operators will elect to participate—due to hauling distance, operational preference, contract structure, or economic thresholds—an additional 15% reduction is applied to account for non-participation. This reduces the effective participation rate from 50% to 35% of gross available biomass.

- Adjusted participation rate: 35% of gross

[1] "Trust Lands 2025 Bid Results." *Montana Department of Natural Resources and Conservation*, dnrc.mt.gov/Forestry/Forest-Products/Trust_Lands_2025_Bid_Results.

- Realistic available biomass supply:
- 963 tons/day × 35% ≈ 337 tons/day

This tiered reduction approach represents a conservative assumption for feasibility-level analysis.

Summary of Available Feedstock

Based on the analysis above, a conservative and realistic estimate of biomass available to a single biomass incineration facility in Lincoln County is approximately:

- **~337 tons per day of sustainably available biomass feedstock**

This estimate incorporates operational realities, competitive market dynamics, participation uncertainty, and conservative safety factors appropriate for feasibility-level planning.

5.2 Operator Specific Supply Validation

Interviews with individual logging companies support the plausibility of the above estimates and provide further insight into pricing and logistics considerations.

5.2.1 Stoken Logging (Eureka & Kalispell, MT)

Stoken Logging Operations reported an annual production volume of approximately 57,000 tons of timber, generating an estimated 11,000 -15,000 tons of biomass waste per year, equivalent to roughly 30 tons/day. Including slash and top pile material, total biomass waste generation increases to approximately 60 tons/day. Operations are conducted five days per week with 10-hour shifts, and the operator estimated that as much as 25% of productive time is currently consumed by biomass waste management activities. Stoken Logging indicated willingness to haul biomass within a 40-mile radius, contingent on a delivered compensation of approximately $40 - 50 per ton.

Stoken generates forest-derived residues that include small-diameter logs, tops, and non-merchantable material produced from U.S. Forest Service (USFS) and private timber sales. Material characterization of typical forest-slash will reflect freshly cut “green” conditions unless stockpiled for drying at Stoken Logging’s yard in Eureka. There is low potential for contamination due to the practice of de-limbing trees at the harvest site, which limits dirt and rock carryover while complying with USFS requirements to retain limbs on the forest floor for nutrient recycling. Resulting material is primarily stem-only residues transported as logs before being processed at the Eureka yard. Overall, potential feedstock is a clean woody biomass stream with physical characteristics suitable for energy conversion systems that rely on forest residues – drying and preprocessing will be required.

Type of feedstock

- *Forest residues / slash:* tops, small-diameter logs, off-spec species.
- *Potential sawmill-equivalent residues:* Stoken does not operate a mill, but they own the Stoken Rentals property in Fortine where logs could be chipped and processed.

- *Moisture Content (MC):* Not directly measured; material will be green and freshly cut unless stored at Stoken's yard.
- Waste logs (small-diameter stems) would be hauled intact to Fortine yard.
- Grinding/chipping performed at yard

Contamination

- De-limbing conducted at the harvest site → low dirt/rock contamination.
- Can meet clean woody biomass specifications .

Supply Availability

Stoken Logging operates across a region spanning from Libby to Swan Lake, with most activity concentrated around Eureka, Montana. Annual logging production averages 10 to 11 million board feet, generating an estimated 60 tons/day of slash during active operations. With a work schedule of five 10-hour days per week, this equates to roughly 15,600 tons of recoverable residual biomass per year from USFS contract; additionally volumes from private-land harvesting are continuing to increase with increased annual development and migration to the surrounding area. *Stoken identifies Eureka as the most practical location for centralized handling and processing*. Despite long-term reductions in USFS timber sale sizes, Stoken anticipates stable activity levels over the next three to five years, with hopes of increasing availability due to the new legislation and action of the current administration, thus supporting reliable regional feedstock availability.

Region

- Core radius around Eureka; operations extend from Libby down toward Swan Lake.
- Preferable haul distance of 40 miles - Eureka is the ideal location for a receiving facility.

Feedstock Volumes

- Average timber production: 10–11 million board feet/year (last 3–4 years).
- Slash/waste generated: ~ 60 tons/day, 5 days/week → ~15,600 tons/year of recoverable waste-volume potential.
- Region contains many small logging firms, but most are significantly smaller than Stoken – 70 companies
- Expected volumes at project startup: same or higher, given anticipated increase in private blowdown harvests.

Seasonality

- No logging March–May (spring breakup / wet season).
- Slash available June–February.

Contractability

- ~70 companies deliver to Weyerhaeuser.
- 2–6 companies bid head-to-head on timber sales.
- Long-term contracts are possible and preferable

Costs & Handling

Stoken prefers a centralized preprocessing model in which waste logs are clipped at the harvest site and transported to the company's Eureka yard for grinding or chipping. Load sizes typically range from 33 to 35 tons using short log trucks with pup trailers, supported by a fleet of four company-owned trucks and three subcontracted units. Slash volumes are not measured as precisely as merchantable timber, which makes cost estimation for waste biomass challenging.

- Tipping rate required for biomass delivery: *~$50/ton* (to make hauling/slash diversion viable).
    - Stoken prefers centralized preprocessing at their Eureka yard:
    - Clip waste logs in forest (limbs stay onsite) and haul small logs to yard.
    - Use dedicated grinder/chipper at yard - Stoken would invest if subsidized or under a long-term agreement.
- Transportation
    - *Load size:* 33–35 tons/load (short log truck + pup trailer).
    - *Routing:* Forest → Eureka yard → biomass facility.
        - 7 log trucks available (4 company-owned full-time, 3 subcontractors).
- Cost Data Challenges
    - Logging economics are driven by timber sale pricing and tonnage expectations set by USFS and Department of Natural Resources (DNRC)
    - Slash volumes are estimated but not measured consistently — typical uncertainty for waste streams.

Risk & Resilience

Stoken Logging expects no major shifts in market demand or regulatory conditions that would reduce harvest activity over the next several years. Seasonal constraints are consistent and reliable, as spring conditions present operational limitations from March through May. Primary timber markets focus on merchantable logs rather than waste material. However, log markets for pulp, studs, plywood, and fencing continue to influence harvesting economics. Feedstock security can be further achieved through

formal memoranda of understanding (MOUs) with Stoken Logging, establishing secured annual tonnage commitments in the range of 10,000 to 15,000 tons.

Market/Policy Impacts on Supply

- No major policy changes currently anticipated.
- USFS timber sale volumes have decreased over decades but have some recent stability
- Competing markets include pulp (Weyerhaeuser pays ~$30/ton), stud logs ($70/ton), plywood logs ($90/ton), fencing ($50/ton); competition for slash is low.

Operational Risks

- Feedstock seasonality: 3-month spring shutdown (March–May).
- Access limitations for large grinders in forests → requires yard processing.
- Workforce shortages regionally but Stoken maintains 25 employees.

Feedstock Security

- Potential to develop MOUs with Stoken Logging to secure fixed tonnage annually.
- Stoken capable of increased diversion if economics improve
- Forest Service estimates that there is 700,000 tons in the region surrounding Fortine; concluded that there is sufficient fiber to fuel a power and heat generating plant in the Fortine area.
- Biomass on private lands are owned and utilized by plum creek and Stoltz Land and Lumber.

Long term contracts to assure certainty will be needed for the facility to have financial feasibility.

5.2.2 Vincent Logging (Libby, MT)

Supply Availability

Vincent Logging Operations reported current biomass generation of 60–80 tons per day, harvesting material down to a 1.5-inch top. Under existing operations, the company indicated it could reliably deliver two mule-train truckloads per day, or approximately 66 tons/day, to a nearby biomass facility. Vincent Logging indicated that if material specifications were relaxed to a 1-inch top, a delivered price of approximately $45–50 per ton would be sufficient to make hauling biomass economically viable. Operations and supply activity are centered around Libby, Montana, with historical activity reaching the surrounding areas of Montana and Idaho. The company trucks timber material up to 50–60 miles from Libby, and past operations included hauling small-diameter pole/post logs as far as Plummer, ID.

Feedstock Volumes

- Approximately 40–50 tons of slash/waste are generated per day from logging activities.

- Roughly 50% of the timber sale volume becomes slash.
- Historical and projected timber approvals:
  - Overall timber sales formerly exceeded 200+ million board feet/year before recent legal constraints.
  - Recent approval levels have ranged from 5–70 million board feet/year, with ~40 million board feet approved for 2026.
  - A conversion figure was confirmed: 250 tons ≈ 1 million board feet.

Seasonality

- Timber sale approval delays (7+ years through courts).
- Slash handling practices such as leaving piles for multiple years at certain sites.

Contractability

- The company's product markets are stable but limited:
  - Idaho Forest Group (IFG): ~80%
  - Thompson River Lumber: ~20%
- Market flexibility is limited by federal policies and long approval timelines for timber sales.
- Potential exists for new contract structures, especially with:
  - Multi-party partnerships,
  - Expanded Master Stewardship Agreement (MSA) areas, and
  - A future haul or tipping fee agreement

5.3 Costs and Handling

5.3.1 Tipping Rate

A tipping fee or per ton rate of $40–$50 per ton is necessary to make biomass hauling financially viable.

5.3.2 Transportation

- Maximum economic haul radius: ~50 miles.
- A proposed 25-mile radius is considered feasible.
- Conventional haul equipment: Truck with pup load, carrying ~33 tons per load.

5.3.3 Cost Data Challenges

- Slash handling costs vary widely based on landownership and sale conditions:
  - Federal land: U.S. Forest Service burns slash (cost not borne by logger).
  - State/private land: Logger is responsible for burning.
- Timber approvals are constrained by litigation; approval risk translates to uncertain supply and cost planning.
- Past investors interested in a Co-gen opportunity withdrew due to lack of federal commitment to timber supply, introducing long-term financial uncertainty.
- Policy-driven fluctuations, including:

    - Sunset of the federal black liquor tax - discussions about reinstatement continue.
    - Market and political changes affecting timber availability.

5.4 Risk and Resilience

5.4.1 Market/Policy Impact on Supply

- Timber supply is heavily influenced by federal policy and court action:
    - Timber sales take 7+ years for approval
    - Local Managers only propose sales they believe can survive court challenges
- Policy Shifts:
    - Both political parties have shown increasing awareness of forest management issues, influenced by major fires in other densely populated western states.
    - Expansion of the MSA area is more efficient and achievable through judiciary rather than legislative action

5.4.2 Operational Risks

- Logging activity depends on:
    - Lengthy approval cycles
    - Variability in annual board-foot approvals
- Slash can accumulate and remain unused for years, which creates risk of degradation or lost revenue opportunities.
- Hauling cost viability is sensitive to per-ton rates and haul distances
- Equipment investment risk mitigated only if secure agreements exist.

5.4.3 Feedstock Security per Bruce Vincent

- Approximately 150,000 acres of Wildland Urban Interface (WUI) land in the Kootenai area is sufficient to support a 25 MW biomass facility.
- The MSA is expected to be renewed without issue upon expiration.
- Potential exists to expand the managed area from 0.5 miles to 1 mile on each side of access corridors.
- Collaborative models (e.g., Green Diamond, technology/O&M partners, local loggers) are seen as essential to ensuring secure feedstock flows.

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6 Technology Review & Selection Framework

This technology review framework primarily focuses on commercially proven direct combustion technologies for municipal solid waste (MSW) and biomass, including reciprocating grate systems, fluidized bed combustors, traveling grate systems, suspension firing, and modular starved air type units. These technologies have demonstrated long-term operational reliability across multiple full-scale installations. Gasification and pyrolysis technologies are also examined within this framework given their potential relevance to MSW and biomass thermal conversion. While these systems have shown development progress in certain applications, they have much more limited operating histories and commercial deployment for unsorted MSW at scale when compared to direct combustion technologies.

The proposed project requires technologies that can reliably convert woody biomass and/or MSW into renewable energy in any combination or blend of fuels. The technologies evaluated have established operating track records at medium- to large-scale throughputs, high availability, and mature air-pollution control systems. The assessments for gasification and pyrolysis technologies are intentionally reduced because they do not align with some or all of the following:

- Client's objectives
- Lack of viability at commercial scale
- High capital investment, including maintenance costs on a per ton basis
- Significant O&M challenges.

Waste-to-Energy (WTE) technology designs and operational considerations are engineered to process specific feedstocks. MSW mass-burn combustion is a mature, commercially deployed technology operating successfully at a wide range of scales. Similarly, direct combustion systems designed for woody biomass are well established. However, blending MSW and biomass and co-firing can lead to operational issues such as instability, fuel handling, ash management, burnout, boiler fouling; reduced efficiency; or increased maintenance requirements in direct-combustion WTE systems.

For the purposes of this technology review, HDR is defining "commercial viability" as:

1. An ability to process a heterogenous mixture addressing the breadth of components (paper, plastic, metals, organics, and glass) and physical and chemical properties found in a typical MSW stream or an ability to process woody biomass;
2. A presence of one or more vendors operating one or more existing full scale commercial facility currently operating in the United States for a minimum of three years processing typical MSW or biomass.
3. A processing throughput capacity equal to or greater than the solid waste flow within a given waste jurisdiction; and
4. A maximum number of four individually continuously operating units.

6.1 Fuel Comparison:

6.1.1 Municipal Solid Waste

Municipal solid waste is a heterogeneous fuel composed of primarily household refuse, commercial waste, and non-hazardous industrial discards. Its composition varies by region, season, and local recycling practices and economic drivers, but typically includes paper, plastics, food waste, yard waste, textiles, and small quantities of metals and inert material. This variability has a direct impact on fuel consistency and heating value.

Typical Characteristics of MSW

- Higher Heating Value (HHV): ~4,000–6,000 Btu/lb (wet as received), depending heavily on moisture and organics content
- Moisture Content: 25–40%
- Ash Content: 20% to 35%
- Fuel Variability: High; composition changes daily and seasonally. For small units this can be even more important.

MSW can support continuous boiler operation with proper combustion control and grate design, but its heterogenous nature and characteristics necessitates robust fuel handling, boilers, emissions control, and residue management.

6.1.2 Woody Biomass

Woody biomass includes forest residues, wood chips, and sawmill byproducts. Compared to MSW, biomass is more homogeneous, predictable, and generally easier to combust.

Typical Characteristics of Woody Biomass:

- Higher Heating Value (HHV): ~7,500–9,000 Btu/lb (dry basis), typically ~4,000–6,500 Btu/lb as-received depending on moisture
- Moisture Content: 20–50% depending on storage and processing
- Ash Content: Very low (3-7%)
- Fuel Uniformity: Higher (especially for chipped or screened biomass). This is compared to MSW.

Biomass provides more stable combustion conditions and produces a cleaner, more limited ash stream than MSW, although moisture variability can still influence boiler performance. Biomass also generally allows the use of lower cost material handling systems, boilers, and emission control systems.

6.2 Direct Combustion

6.2.1 Grate Systems

Grate combustion systems represent the most established platform for converting solid waste fuels—including municipal solid waste (MSW), biomass, and refuse-derived fuel (RDF)—into usable thermal energy within waste-to-energy (WTE) facilities. These systems rely on mechanically driven grate surfaces to transport fuel through the

combustion process while ensuring controlled drying, ignition, burnout, and ash removal. Among the technologies used, reciprocating grates and traveling grates are the two dominant configurations, each offering distinct advantages depending on fuel characteristics, preprocessing requirements, and facility objectives. Together, these grate-based systems form the backbone of direct-combustion WTE, providing reliable heat release, stable steam production, and the operational flexibility necessary to manage heterogeneous waste streams while supporting modern emissions control and energy recovery goals. We discuss below the two primary types of grates most commonly used worldwide for energy recovery from MSW and from Biomass: Reciprocating Grates and Travelling Grates.

Reciprocating Grate:

Reciprocating grate boiler systems (Figure 6) are a mature and widely deployed combustion technology used in WTE applications for the thermal conversion of MSW, biomass, and other heterogeneous fuels. The system is designed to provide stable, controlled combustion while accommodating the variable composition, moisture content, and heating value characteristic of waste streams.

At the core of the system is the reciprocating grate, a series of interlocking, stepped grate elements that move in a coordinated forward-and-backward motion. This mechanical action and in some cases gravity advances and mixes the waste bed through successive drying, ignition, combustion, and burnout zones. By continually agitating and conveying the material, the grate promotes uniform exposure of the waste to combustion air, enhances burn-out, and limits the formation of large, unburned masses within the fuel layer. Different equipment suppliers each have their own unique designs and arrangements for their grate systems. The grate system is generally integrated with the boiler.

Combustion air is delivered through a combination of underfire (primary) air supplied through the grates and overfire (secondary) air injected above the fuel bed. Primary air supports drying and combustion while cooling the grate, while secondary air enhances turbulence and completes burnout of volatile gases. Modern systems integrate staged-air combustion and automated control logic to manage oxygen distribution, furnace temperature, fuel bed, and flue gas residence time, reducing NOx and CO formation and improving overall combustion efficiency.

Heat generated within the furnace is transferred to the boiler’s waterwalls and convective sections to produce high-pressure (typically around 615 psig) steam. The boiler typically incorporates membrane waterwall construction to withstand the corrosive environment associated with waste combustion. Membrane waterwalls are boiler furnace walls constructed of closely spaced water-filled tubes welded together to form a gas-tight membrane that absorbs heat while enclosing the combustion chamber. Downstream, the steam is routed for electrical generation or combined heat and power applications, while flue gases are conveyed to the air pollution control (APC) system for particulate and emissions treatment prior to being discharged to atmosphere.

Overall, reciprocating grate technology is valued for its robustness, ability to process unsorted MSW, and stable thermal performance across a broad range of waste

conditions. This technology also has the ability to combust biomass but would require tuning depending on the percentage of biomass that is being combusted with MSW or by itself. Such robustness comes at a somewhat higher capital cost and mechanical complexity compared to travelling grates discussed in the section immediately below.

Figure 6: Reciprocating Grate

Travelling Grate:

Traveling grate boiler systems (Figure 7) are a proven, continuous-flow combustion technology commonly used for biomass, RDF, and other moderately processed solid fuels with relatively uniform size and heating characteristics. The system is engineered to deliver steady combustion, as well as automated fuel handling and feeding into the furnace.

The defining feature of the system is the traveling grate, a moving horizontal belt-type grate composed of overlapping, perforated grate plates mounted on chains or rollers. As the grate advances at a controlled speed, fuel is introduced at the feed end and combusted in a semi-suspension manner. Combustion in suspension occurs while the fuel is projected across the boiler to the rear end. Large pieces of fuel and ash will land on the grate toward the rear end of the furnace. It is then slowly conveyed smoothly toward the front of the furnace while combustion is completed and primarily ash remains

at the front of the furnace. At that point, ash falls off the grate and into the ash removal system. Because the grate motion is continuous rather than reciprocating, the fuel bed remains relatively uniform, supporting stable combustion profiles and reduced mechanical wear compared to systems with more dynamic grate movement. The fuel bed is not agitated so it must be managed to maintain proper burnout and minimum bed coverage.

Combustion air is supplied through the grate as underfire air, which passes upward through the fuel layer to promote drying and char oxidation and keep the grate cool. The perforated grate surface promotes consistent air distribution across the width of the grate. Overfire air, injected above the fuel bed, provides additional turbulence and oxygen to complete combustion of fuel in suspension as well as volatile gases.

Steam generation occurs through heat transfer within the furnace's membrane waterwalls and convective boiler passes, in a manner similar to other solid-fuel boiler designs. Traveling grate boilers are often integrated with multi-pass boiler configurations to increase thermal efficiency and minimize fouling. The ash produced during burnout is conveyed to the discharge end of the grate, where it is collected for removal or further processing.

Industry Experience: Mass Burn with Reciprocating Grates vs. RDF with Travelling Grates:

Mass burn units with reciprocating grate furnaces and waterwall boilers combusting MSW are the most prevalent type of medium- and large-scale (processing between 200 TPD and 1,000 TPD per "process line", or boiler unit) WTE technology operating in North America and globally. Many facilities have two or more process line units with overall facility waste throughputs in the range of 400 TPD to as much as 3,000 TPD. Examples of this type of facility include the Pinellas County Resource Recovery Facility, in St. Petersburg, Florida; the Montgomery County Resource Recovery Facility in Dickerson, Maryland; and the Durham York Energy Centre (DYEC) in Ontario.

RDF units with traveling grates combusting RDF and incorporating integral waterwall boilers are generally large-scale processing facilities with capacities of 1,000 TPD or more.

In the United States and Canada, there are approximately 70 WTE facilities, of which, nearly all utilize mass burn technology except for a handful of plants that utilize RDF technology. No new RDF units have been built since the early 1990's.

Major Maintenance and Facility Availability Profiles:

Both Mass Burn and RDF facilities are typically scheduled to operate 24 hours per day, 365 days per year with scheduled boiler downtime typically occurring twice per year to perform major maintenance and repairs. Some facilities will also schedule cleaning outages, as needed, to deslag superheater tubes and convective platens. In North America, the availability of WTE mass burn units, which is the hours a unit is available to process waste in a year as a percentage of a total of 24 x 365 = 8,760 hours per year, typically ranges from 91% and 94% for well-run units. RDF plants, because of their

mechanically complex fuel preparation pre-combustion systems, have often exhibited lower overall availability on the order of 85% to 90%.

The higher availability for a well operated and maintained mass burn WTE unit puts this technology at the higher end of the reliability scale compared to other fossil fuel and renewable power generating technologies.

Implementation Timeline:

Based on HDR's recent experience in North America, the planning, permitting, design, and construction process for a new "Greenfield" mass burn WTE facility is estimated to span approximately eight to ten years. There does not appear to be any significant difference in implementation duration between facilities with mass burn technologies and RDF technologies, since both generally require procurement of long lead time components.

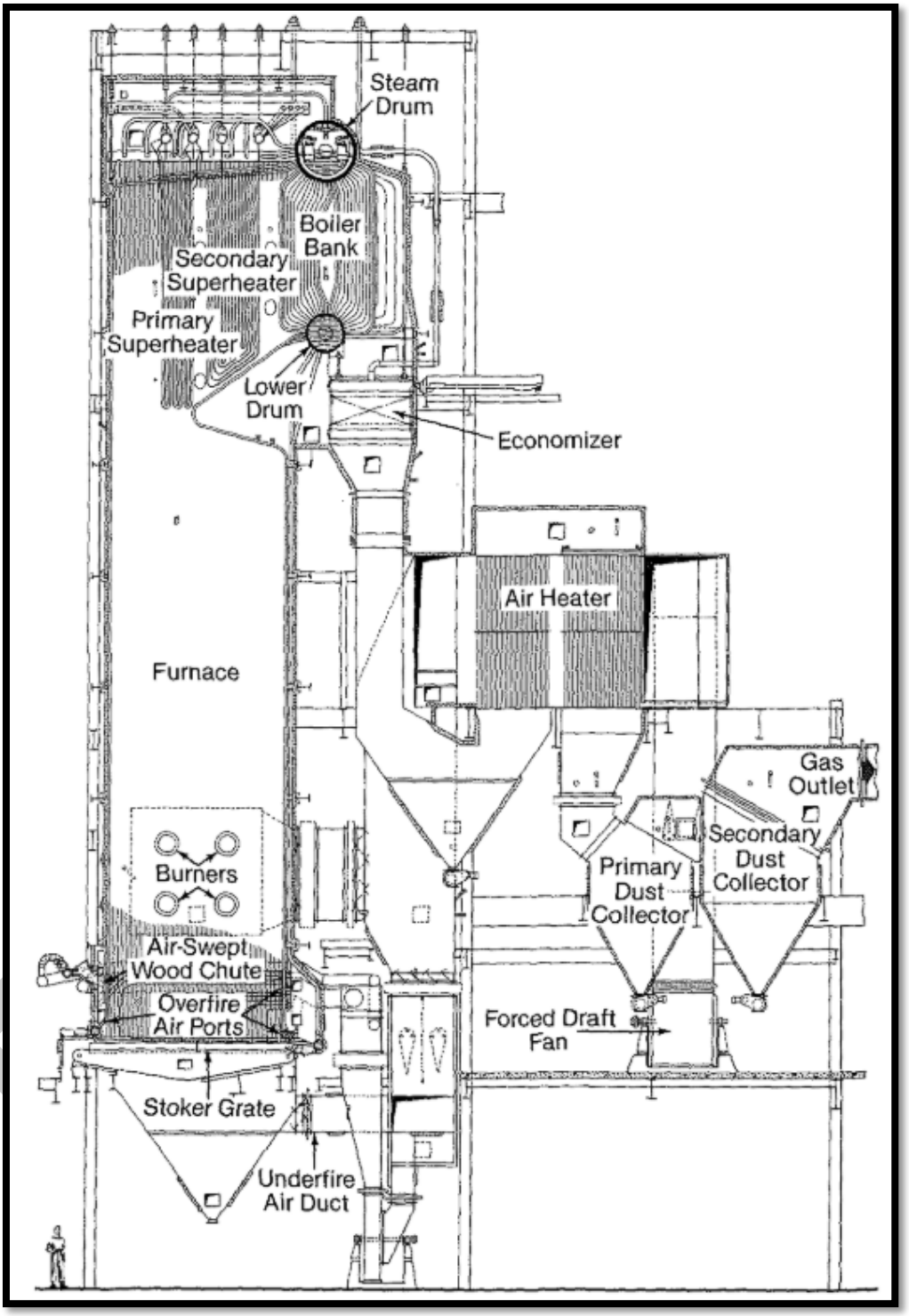

Figure 7: Travelling Grate Boiler Cross Section, from Babcock & Wilcox

6.2.2 Fluidized Bed Systems

Fluidized bed combustors (FBC) represent a combustion platform designed to provide highly efficient, low-emission thermal conversion to energy of solid fuels, especially relatively homogeneous biomass fuels. Unlike grate-based systems that rely on mechanical fuel conveyance, FBC technology suspends fuel particles within a turbulent mixture of combustion air and inert bed material—typically sand or limestone—creating a fluid-like environment that delivers uniform temperature distribution, excellent mixing, and efficient heat transfer. Facilities utilizing circulating fluidized bed (CFB) designs, such as those commonly deployed primarily in modern biomass to energy plants, take advantage of continuous solids recirculation to further enhance combustion stability and fuel flexibility.

In a CFB system, fuel is introduced directly into the fluidized furnace where it quickly mixes with the hot bed material, causing rapid drying, devolatilization, and oxidation. The fluidizing air velocity is sufficiently high to entrain a portion of the bed solids into the upper furnace, where they are carried to a high-efficiency cyclone separator. The cyclone removes the entrained material and returns it to the lower furnace through a loop seal, completing the recirculation loop. This solids circulation provides heat retention, improves combustion completeness, and allows the furnace to maintain consistent temperatures even when processing fuels with variable moisture or heating value.

Combustion air is staged through primary air, which fluidizes the bed and supports fuel oxidation, and secondary / tertiary air, which enhances suspension combustion and reduces emissions through controlled / staged mixing. When limestone is added to the bed, in-situ sulfur capture further reduces SO_2 emissions, making CFB systems particularly attractive for facilities firing high-sulfur biomass or refuse-derived fuels. Woody biomass can contain (depending on type) alkali metals (e.g., K, Na), silica, and traces of calcium and magnesium which are major drivers of bed agglomeration, slagging and fouling. The addition of limestone can result in less sticky, higher melting ash and thereby reduced slagging tendency.

Heat generated in the furnace is transferred through waterwalls and convective boiler surfaces to produce high-pressure steam. The stable thermal environment within a fluidized bed affords excellent load-following capability and high combustion efficiency, even fuels with elevated moisture, or lower heating values. Ash produced during combustion is removed either as bottom ash from the bed drain or as fly ash captured in downstream air pollution control equipment. Few fluidized bed units are known to be operating. The LaCrosse, Wisconsin Facility Unit #1 and 2 are fluidized bed units that combust refuse RDF and some wood. The units were developed from modified and derated coal boilers systems.

Feedstock Flexibility

Fluidized-bed gasifiers accommodate a small variety of chip sizes, approximately 0.25”-1.0” characterized by a moderate to high moisture content of woody biomass streams (forest residues, C&D clean wood). Plainfield operates staged gasification with a conventional boiler system. In retrofitted boiler systems, like Plainfield, clean woody biomass is gasified in a fluidized-bed under staged, controlled conditions to produce a

hydrogen-rich gas. This gas is used as fuel in a close-coupled boiler where complete oxidation occurs under controlled excess air. The resulting steam can be supplied to a conventional steam turbine-generator for power generation or to process users for thermal loads. Compared to direct-fired solid-fuel boilers, this staged approach can improve combustion stability, expand fuel flexibility, and enable lower emissions with modern control suites (baghouse, dry scrubbing, SNCR/SCR). The Plainfield Renewable Energy facility exports ~37.5 MW of power using clean wood feedstock (C&D clean wood, forest residues, and land-clearing debris), with advanced emissions controls and an EPA Title V permit.

6.2.3 Suspension

Suspension fired boiler systems rely on pneumatics to introduce the fuel into the boiler. These systems are designed to burn finely processed, homogeneous fuels—such as biomass fines, RDF fluff, or other pulverized solid feedstocks—by introducing the material directly into the furnace where it burns while suspended in the combustion air stream. Because the fuel is distributed throughout the furnace volume rather than resting on a grate surface, suspension-fired systems achieve rapid ignition, high burnout efficiency, and stable thermal output under properly controlled conditions.

Fuel preparation is a key component: material must be processed to a consistent, small particle size and low moisture and low ash level to ensure predictable pneumatic transport and combustion characteristics. Fuel preparation systems are more complex to achieve the required conditions. Once prepared, the fuel is conveyed through dedicated feeders and blown into the furnace through injection ports. This creates a dispersed fuel-air mixture that supports turbulence, heat release, and complete oxidation of volatile gases.

Combustion air is delivered in staged configurations, typically beginning with primary air used to transport and disperse the fuel and followed by secondary and tertiary air jets that enhance mixing, reduce localized oxygen deficits, and lower NOx formation through staged combustion. Advanced control systems manage air distribution, fuel feed rate, and furnace temperature profiles, ensuring stable operation despite variations in fuel quality.

The heat generated in the suspension-fired furnace is absorbed by membrane waterwalls and downstream convective surfaces to produce high-pressure steam for power production or industrial processes. Ash generated during combustion consists of fine particulate material that exists within the flue gas and is subsequently captured by the air pollution control system, eliminating the need for grate-based ash handling. Dump grates may still be needed, which is a fixed floor that periodically needs to be dumped to a quench tank. However, fly ash loading is generally higher than in grate systems.

6.2.4 Modular

Modular combustion systems (Figure 8) are small-size factory-fabricated, or shop-assembled furnaces and boilers designed for rapid deployment. Unlike large, field-erected direct combustion units, modular systems are delivered in standardized small modules—typically encompassing the fuel handling, combustion system, energy

recovery (when provided), ash handling, emissions control, and the control system. This allows for rapid deployment of additional parallel systems.

Modular systems can accommodate MSW, refuse-derived fuel (RDF), select industrial wastes, and biomass; however, compared with large mass-burn units, they typically benefit from basic preprocessing (e.g., removal of bulky items, size reduction, and non-combustible recovery) to provide for steady feeding and consistent residence time. Moisture tolerance is moderate; performance improves with stabilized heating value and size uniformity. Individual module capacities commonly range from ~5 to 200 tons per day (TPD), with multiple trains operated in parallel to meet higher throughputs.

Primary (underfire) and secondary (overfire) air are delivered in staged configurations to manage furnace temperature, oxygen distribution, and gas-phase burnout. Often units are designed as a two-chamber design. Oxygen trim and furnace pressure control are used to stabilize operation across fuel variability. The primary chamber may operate in a sub stoichiometric manner where less than the necessary oxygen is provided for complete combustion and added combustion air is provided in a secondary chamber to fully combust CO, hydrogen, and hydrocarbons generated in the primary chamber. Grate or fuel beds are often a series of one to three rams and steps resulting in limited mixing and exposure of fuel. Generally, all combustion air is provided as overfire air. Because of their smaller volume, modular units often run slightly higher excess air to ensure complete burnout and protect refractory and heat-transfer surfaces, with tuning to minimize efficiency penalties. Sub stoichiometric units and even excess air units sometimes struggle with full burnout of fixed carbon in the fuel.

Heat is recovered either via waste heat waterwall boiler sections (in remote waterwall modules) or convective heat exchangers (following refractory-lined primary/secondary chambers). Steam conditions are generally more modest than utility-scale mass-burn (e.g., low to medium pressure/temperature) to match materials of construction. Plants frequently operate multiple modules to supply a common steam header for district heating, industrial process steam, or power generation at small scale (e.g., backpressure turbines for combined heat and power). Energy recovery, when incorporated, is usually significantly less efficient than larger field erected units.

Modular trains are paired with compact APC systems sized to each line or shared across multiple lines, commonly including cyclones or multi-clones for large particulate, dry or semi-dry acid gas control (e.g., sodium bicarbonate or lime injection), activated carbon for mercury/organics, and fabric filters (baghouses) for final particulate removal. Bottom ash is discharged from the primary chamber or grate surface and conveyed to final disposal or may require periodic manual cleaning for some models; fly ash is collected from the APC. The higher proportion of fly ash typical of small combustors is addressed through conservative APC design and reagent/temperature control. A common disadvantage of modular units processing MSW is the buildup of hard residue “clinkers” on the combustion surface or furnace “floor”, where such clinkers build up to relatively large sizes, and eventually block the push-blade that normally moves the waste along the floor. Also, modular systems have fallen out of favor as a result of the poor economics of scale from requiring increasingly rigorous flue gas cleaning systems beginning in the 1980’s and 1990’s.

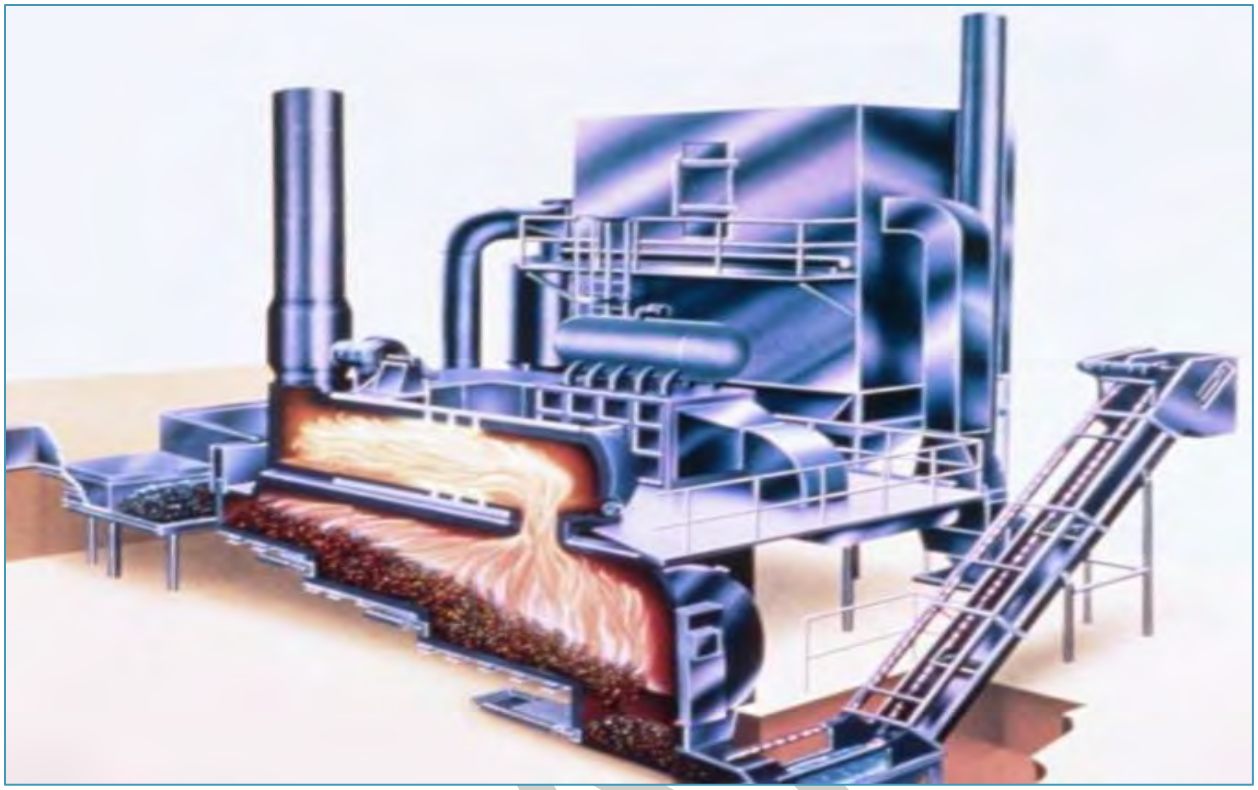

Figure 8: Typical Modular Mass Burn WTE Unit Cross Section, from Consutech Incinerators LLC

6.2.5 Direct Combustion with Combined Heat and Power (CHP) Technology Example

F.H. Stoltze Land & Lumber, a family-owned sawmill in Columbia Falls, Montana, has been operating since 1912 and manages about 38,000 acres of timberland. In 2012, the legacy, inefficient boiler system was replaced with a CHP system. The advanced system supports onsite lumber drying efficiently, generates renewable electricity, and mitigates slash pile burning.

The new CHP system began operating in 2013 under a 20-year Power Purchase Agreement with Flathead Electric and operates at a capacity of approximately 60,000–65,000 green tons (30,000 - 35,000 bone dry tons) of wood residues annually—bark, sawdust, planer shavings, and hog fuel (11Appendix I). The combustion process produces high-pressure, superheated steam. The steam spins a Dresser Rand extraction turbine connected to a Toyo Denki generator, which has a capacity of approximately 3.75 MW. Mill and kiln operations demand a 1.0MW parasitic load. Steam production varies from 1,000 to 5,000 lbs/hr, depending on kiln needs. The remaining electricity is sold to Flathead Electric Cooperative (FEC) representing approximately 2.5 MW.

After passing through the turbine, lower-pressure steam is extracted for on-site uses, including lumber drying and space heating, supporting the mill's production of roughly 70 million board-feet of lumber, annually. The lumber mill employs approximately 132 personnel, with an operations team that includes eight boiler operators supported by

maintenance staff and management. Staffing reliability and the availability of qualified boiler operators were identified as ongoing challenges.

The boiler is designed for 24/7 year-round operation, with contractual obligations to operate 350 days per year, achieving 83%–97% uptime. The system processes approximately 8 green tons per hour, equating to roughly 67,000 tons/year – all sourced within a 35-mile radius. Beneficial use of steam was emphasized as important to maximize project viability. Ash disposal requires Class III landfill placement for 95% of byproduct, while 5% is sold. Total ash generation is approximately 8 tons per day.

Lessons Learned from Stoltze Interview

- A multi-cell boiler would have been preferable to their existing single-cell system, which would offer redundancy during periods of downtime for maintenance. The “cells” are the combustion portion of the boiler that is a semi-suspension / travelling grate technology.
- Fuel moisture management and covered storage significantly affect operating efficiency.
- Adequate spare-parts inventory is critical due to long lead times and limited regional supply.
- Workforce availability is a major constraint for boiler operations.
- Early planning must address interconnection requirements and potential high upgrade costs.
- Ensuring a continuous, affordable feedstock supply is essential, including balancing mill residuals with purchased biomass.
- Maintaining compliance with air permitting and reporting requirements is a persistent operational responsibility.

6.2.6 Gasification

Gasification is a thermal conversion process that operates with sub-stoichiometric oxygen, producing a combustible synthesis gas (syngas) rather than completing the combustion of the fuel in a single step. Waste is heated to drive off moisture and volatiles, and the remaining material undergoes partial oxidation to form a mixture of carbon monoxide, hydrogen, and light hydrocarbons. This syngas is typically directed to a secondary combustion chamber or boiler for full oxidation and heat recovery.

While gasification may offer cleaner upstream thermal conditions and lower excess air requirements, full-scale deployment for mixed MSW and biomass has been limited. Most systems face operational challenges related to feedstock variability, tar management, ash handling, energy recovery, emissions controls, and the possible need for extensive fuel preparation and controls. Because the units are typically refractory lined steel vessels with waste heat boilers and have other limitations the life expectancy may be less than for larger waterwall grate combustion systems. Life may be limited to twenty years or less.

Plainfield Renewable Energy System CHP Retrofit:

The Plainfield Renewable Energy (PRE) facility in Connecticut includes a boiler and steam turbine combined with staged gasification of clean woody biomass instead of direct combustion. In this configuration, biomass is first gasified in a fluidized bed, limited

oxygen environment to produce a hydrogen rich synthesis gas. That gas is used as fuel in a close coupled boiler to generate steam, which feeds a conventional steam turbine generator set.

A biomass fired fluidized bed staged gasifier with a boiler driving a steam turbine generator is installed. This process replaces the boiler's role as a primary combustion chamber with gasifier led staged oxidation, improving control over temperature, residence time, and air distribution.

- Approximately 37.5 MW (net) of renewable power
- 350,000 tons/year of clean wood (construction/demolition wood meeting NHSM criteria, forest residues, land-clearing debris, and industrial waste wood).

6.2.7 Pyrolysis

Pyrolysis is a thermal decomposition process conducted in the absence of oxygen (or very low levels), converting municipal solid waste (MSW), refuse-derived fuel (RDF), or biomass or certain portions of these waste streams such as plastics or tires into a mixture of pyrolysis gas (e.g., Hydrogen, carbon monoxide and carbon dioxide, methane, light hydrocarbons), condensable oils, and char. Because limited direct oxidation occurs in the primary chamber, pyrolysis requires tightly controlled heating and fuel preparation, typically involving size reduction and removal of inorganics—to ensure uniform temperature distribution and predictable product yields.

For MSW applications, pyrolysis systems generally rely on highly processed RDF, as raw MSW is too heterogeneous for stable operation. The gas and vapors produced during pyrolysis typically require secondary combustion before entering the boiler or air pollution control system, while the remaining char or carbonaceous residue (carbon-rich) is either combusted for additional energy recovery or handled as a residual solid. The liquid fraction of bio-oil can also be used to make renewable diesel fuel, sustainable aviation fuel, gasoline hydrocarbons; however, the quantity is considered low and cost prohibitive.

Although pyrolysis is reported to offer potential advantages in specialty waste streams and certain industrial applications, commercial-scale deployment for mixed MSW has been limited. Technical challenges include fuel processing requirements, tar, wax, and oil handling, system complexity, and the need for reliable continuous operation as well as identifying and obtaining the required feedstock in adequate quantities at an economical price.

6.3 Technology Summary

A range of thermal conversion technologies can be considered for processing solid fuels, including MSW, biomass, and RDF. For smaller-scale facilities, the most relevant technologies include reciprocating grate systems, traveling grate systems, fluidized bed combustors, and modular combustion units. Other technologies are less developed and, in some cases, may be still in conceptual status.

6.3.1 Reciprocating Grate Systems

Reciprocating grates are widely used for MSW and offer strong fuel flexibility, handling variable moisture content and heterogeneous feedstocks. Their mechanical conveying action supports consistent burnout and stable steam generation. However, these systems tend to be larger, more capital-intensive, and generally optimized for medium-to-large municipal-scale throughput rather than smaller distributed applications.

6.3.2 Traveling Grate Systems

Traveling grates perform well with biomass and processed fuels that exhibit relatively uniform size and heating value. Their continuous-motion design allows stable combustion and moderate capital cost, although they are less suited to highly variable raw MSW without preprocessing. For smaller plants with a biomass-dominant feedstock, traveling grates can be a viable option, provided MSW volumes are modest and adequately conditioned. Operational costs necessary for fuel sizing and preparation may be a trade-off to the lower capital cost.

6.3.3 Fluidized Bed Combustors

Fluidized bed systems provide excellent fuel flexibility and high combustion efficiency for a wide range of engineered or preprocessed fuels, including biomass and RDF. Their stable thermal environment and strong mixing characteristics support good emissions performance. However, fluidized bed units typically require very consistent fuel sizing and necessitate preprocessing of raw MSW (especially pre-combustion removal of heavier waste fractions such as glass or metal particles within the RDF) For small-scale facilities, capital and O&M complexity may be higher than alternatives, making them more appropriate when fuel preparation infrastructure already exists. Few systems are in operation which may imply economic or operational limitations.

6.3.4 Modular Combustion Systems

Modular systems—often controlled-air or small grate-based units—are specifically designed for small to mid-size operations. They offer factory-built standardization, rapid installation, and the ability to scale capacity by adding parallel modules. These units can process woody biomass reliably and can accept MSW, though they generally benefit from basic preprocessing such as bulky waste removal and light sizing. Their simpler layout, lower upfront cost, and operational flexibility make them well-suited to distributed or community-scale energy applications. They may have low sophistication grates, refractory lined combustors, simple or even manual ash systems, waste heat boilers which may result in reduced thermal efficiency and operating cycles.

6.3.5 Gasification and Pyrolysis

While gasification and pyrolysis provide alternative thermal conversion pathways, commercial deployment for mixed MSW remains limited. Both technologies may require extensive preprocessing, feedstock control, limited thermal efficiency, operational

limitations, and complex gas cleanup systems. For smaller facilities with variable waste inputs, these approaches are generally not practical or cost-effective.

6.4 Technology Decision Matrix

A technology decision matrix was developed to evaluate and compare candidate waste-to-energy conversion technologies in a consistent manner. The matrix is intended to identify technologies that best align with the composition of available feedstocks, project objectives, regulatory conditions, and long-term operational considerations. Each technology is evaluated against a defined set of criteria that collectively reflect technical performance, economic viability, operability, environmental outcomes, and risk. Weighting factors are applied to each criterion to emphasize those considerations most critical to the success of a WTE project in Lincoln County as follows:

MSW Processability – 10%

Biomass Processability – 30%

Comingled MSW and Biomass Processability – 15%

Economic and Financial – 15%

O&M Complexity – 5%

Permitting Siting & Public Acceptance – 5%

Integration and Constructability – 5%

Risk and Long-Term Reliability – 5%

Environmental Performance – 10%

Then each technology was rated on a scale from 1 to 4 with 1 being the worst rating and 4 being the best rating. The total rating was then calculated by dividing the rating for each criterion by 7 (total number of technologies being considered) then multiplying that quotient by the weight. For example, with a weight of y=10 and a rating of z=3.5:

$$x = \frac{z}{7} * y$$

$$x = \frac{3.5}{7} * 10$$

$$x = 5$$

Feedstock compatibility is the primary driver in the technology evaluation and therefore receives the highest cumulative weighting. Biomass processability (30 points) is weighted most heavily to reflect the strategic importance of woody biomass and related residuals within the region. The ability of technology to reliably handle local biomass feedstocks—considering moisture content, variability, preprocessing requirements, and throughput limitations—is a key determinant of technical feasibility. Commingled MSW and biomass processability (15 points) further evaluates system flexibility, recognizing the potential benefit of co-processing municipal solid waste and biomass to improve fuel supply resilience and facility utilization. MSW processability alone (10 points) assesses each technology's capability to handle typical municipal waste streams, including tolerance for heterogeneity, contaminants, and seasonal variability.

Economic and operational considerations are also included. Economic and financial performance (15 points) evaluates capital costs, operating costs, energy conversion efficiency, revenue potential, and overall lifecycle cost implications. Operations and maintenance (O&M) complexity (5 points) considers staffing requirements, operator expertise, maintenance intensity, and spare parts availability, with preference given to technologies that reduce operational risk and long-term cost exposure.

Several criteria address implementation risk and long-term performance. Permitting, siting, and public acceptance (5 points) evaluates regulatory familiarity, permitting pathways, and historical acceptance of each technology, recognizing that novel or less-proven systems may face heightened approval or stakeholder challenges. Integration and constructability (5 points) assess the maturity of commercial references, modularity, and compatibility with balance-of-plant systems. Risk and long-term reliability (5 points) considers technical maturity, operational track record, performance guarantees, and sensitivity to feedstock variability over the life of the facility.

Environmental performance (10 points) rounds out the evaluation by considering emissions profiles, residue generation, water usage, and overall alignment with environmental compliance requirements and sustainability goals. Technologies demonstrating lower emissions, manageable residuals, and strong environmental controls are scored more favorably.

By applying weighted scoring across these criteria, the technology decision matrix provides a defensible framework for identifying WTE technologies that best balance feedstock compatibility, economic performance, regulatory viability, and long-term reliability. The results, shown in Table 4, support informed decision-making and help ensure that shortlisted technologies are well suited to the regional context and project objectives in Lincoln County.

Table 4: Technology decision matrix scoring and weightage

		Combustion										Thermochemical Conversion			
		Reciprocating Grate		Traveling Grate		Fluidized Bed		Suspension		Modular		Pyrolysis		Gasification	
Criteria	**Weightage**	Rating	Total	Rating	Total	Rating	Total	Rating	Total	Rating	Total	Rating	Total	Rating	Total
MSW Processability	10	4.0	5.7	2.5	3.6	1.0	1.4	2.3	3.2	3.5	5.0	1.0	1.4	1.5	2.1
Biomass Processability	30	2.0	8.6	3.0	12.9	2.5	10.7	2.5	10.7	3.3	13.9	1.5	6.4	1.5	6.4
Comingled MSW and Biomass Processability	15	2.5	5.4	2.0	4.3	1.5	3.2	2.0	4.3	2.3	4.8	1.0	2.1	1.5	3.2
Economic & Financial	15	2.0	4.3	2.0	4.3	1.5	3.2	1.5	3.2	1.5	3.2	2.0	4.3	2.0	4.3
O&M Complexity	5	2.0	1.4	1.0	0.7	1.5	1.1	1.5	1.1	2.5	1.8	2.0	1.4	2.0	1.4
Permitting, Siting & Public Acceptance	5	1.0	0.7	2.0	1.4	1.8	1.3	1.5	1.1	3.0	2.1	2.0	1.4	2.0	1.4
Integration and Constructability	5	1.0	0.7	1.0	0.7	1.0	0.7	1.5	1.1	3.5	2.5	1.0	0.7	1.5	1.1

		Combustion										Thermochemical Conversion			
		Reciprocating Grate		Traveling Grate		Fluidized Bed		Suspension		Modular		Pyrolysis		Gasification	
Risk and Long-Term Reliability	5	3.0	2.1	2.3	1.6	2.5	1.8	2.5	1.8	2.0	1.4	1.0	0.7	1.0	0.7
Environmental Performance	10	3.0	4.3	3.0	4.3	3.0	4.3	2.8	3.9	3.0	4.3	3.0	4.3	3.0	4.3
Total	100.0	20.5	**33.2**	18.8	**33.8**	16.3	**27.7**	18.0	**30.4**	24.5	**39.1**	14.5	**22.9**	16.0	**25.0**

7 Site and Technology

7.1 EUREKA AREA

7.1.1 Stoken Rentals Site – Direct Combustion Woody Biomass

The objectives of this investigation were to evaluate whether regional processing capacity for woody biomass and municipal solid waste (MSW) is viable. These feedstocks may be processed independently or together, depending on the selected processing technologies and economically viable feedstock logistics. Four (4) potential site locations were identified and evaluated for facility development. The Stoken Logging site is located in unincorporated Lincoln County near Fortine, MT. This site is not governed by municipal zoning, and land use regulation is administered directly by the Lincoln County Planning Department through subdivision and conditional use permits.

The site has a longstanding industrial and logging history, which supports consideration of biomass processing or energy generation as a compatible use. In the Eureka area, the former Stoken mill site scored higher than the Eureka Landfill in the site evaluation. MSW generated in Eureka is currently transferred from the Eureka Landfill to the Libby Landfill for disposal. MSW was included in the feedstock assessment to determine whether this long-haul transfer could be reduced or eliminated by developing MSW processing capacity in the Eureka area.

The Eureka Landfill site scored poorly in the decision matrix, primarily due to its proximity to sensitive receptors, limited available operational area, the need for significant investment in high-capacity transmission infrastructure, and required on-site infrastructure improvements. Collectively, these factors reduce the feasibility of developing a waste-to-energy facility at this location. If Lincoln County remains committed to reducing MSW hauling between Eureka and Libby, substantial upfront investment and comprehensive planning would be required to make development at this site feasible.

The former Stoken Rentals site presents the highest overall feasibility for facility development in the Eureka area. The site’s industrial history, available footprint, and separation from sensitive receptors further enhance its suitability for development. Existing site infrastructure and utility connections provide a strong foundation to support a direct-combustion woody biomass-to-energy facility. its location offers logistical advantages for receiving woody biomass feedstocks and potential integration with regional waste management objectives, making it the most practical and cost-effective option evaluated for near-term implementation in the Eureka/Fortine area.

7.2 LIBBY AREA

7.2.1 Port Authority Mill Site

The Libby area evaluation focused on identifying appropriate, commercially viable technologies capable of processing regional woody biomass and municipal solid waste (MSW) while weighing site constraints, economics, regulatory requirements, and

long-term waste management objectives for Lincoln County. The Libby area already functions as the County's primary MSW disposal hub. Two candidate sites were evaluated within the Libby area, the Lincoln County Landfill and the Port Authority Mill (Kootenai Business Park). The Port Authority Mill site has the highest overall feasibility for development in the Libby area. Its large industrial footprint, existing utility infrastructure, rail and highway access, separation from sensitive receptors, and prior history as a wood-products manufacturing facility collectively support near-term deployment of biomass energy systems and potential long-term expansion**.**

Phase 1: Direct Combustion Woody Biomass

Direct-combustion woody biomass technology represents the most appropriate and lowest-risk option at the Port Authority Mill site. The local feedstock of forest residues, logging slash, small-diameter material, and clean wood waste from landfill operations—matches well with grate-based biomass combustion systems that are widely deployed and proven.

In deployment of biomass energy capacity, the Port Authority Mill site could support future MSW thermal processing, subject to permitting, financing, and policy alignment. Two distinct technology pathways are viable, each with different development timelines and risk.

Phase 2: Modular MSW Incinerator

A modular MSW combustion system represents the most practical and flexible approach for introducing MSW processing capacity in Libby in the medium term. Modular units can be deployed incrementally, allowing throughput to scale with MSW volumes while minimizing upfront capital investment and permitting exposure.

- Individual modules (typically 5–200 TPD) align with Lincoln County's MSW volumes and reduce the need for long-term waste import.
- Multiple units can be added over time to increase capacity, providing redundancy and operational resilience.
- Modular MSW units could support continued waste management following closure of landfill cells or changes in disposal practices.
- Physical site compatibility: The Port Authority Mill has sufficient acreage and buffering to accommodate multiple trains, ash handling, and emissions control equipment.

Limitations of modular systems include lower electrical efficiency, less efficient combustion (higher fly-ash percentages), and reduced economies of scale. These constraints may be acceptable when balanced with shorter development timelines, reduced CAPEX, and reduced financial risk.

Alternative Technology: Conventional Direct Combustion Mass Burn

A centralized conventional mass-burn facility using reciprocating grate technology to process a commingled MSW/wood waste feedstock is also a viable option at the Port Authority Mill site. This kind of facility can offer energy recovery efficiency and greater throughput capacity, but commingling MSW and woody biomass as feedstock for a centralized system is not specifically what this technology is designed to process. There

are organic materials (green waste, food waste, wood waste) within MSW feedstock. However, non-organic material makes up most of the material in the feedstock (approximately 20-40% organic material). Much of the regional feedstock in Lincoln County at this proposed facility is woody biomass. This brings a higher risk when using this technology. Conventional mass-burn facilities can have significant development barriers:

- Conventional mass-burn facilities typically require 8–10 years for planning, permitting, financing, and construction.
- Economies of scale favor larger MSW volumes, which may exceed local generation without waste import agreements – very high CAPEX.
- MSW incineration within a PM non-attainment area and near multiple Class I airsheds would trigger heightened scrutiny, extensive air modelling, and prolonged stakeholder engagement.

The Port Authority Mill site offers the most practical and adaptable platform for implementing waste to energy technologies in the Libby area. A phased development strategy—beginning with direct-combustion woody biomass and preserving optionality for future MSW processing—aligns with feedstock availability, utility constraints, permitting realities, and financial risk management. This approach supports immediate progress toward Lincoln County's waste diversion, renewable energy, and forest-health objectives while maintaining flexibility to respond to future policy, market, and regulatory conditions.

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8 Technology Cost & Anticipated ROI

A high-level pro forma analysis was conducted to estimate the net present value of both the direct-combustion woody biomass technology and the modular MSW incinerator technology. For each analysis, revenues evaluated included electricity generation, ferrous and non-ferrous metal recovery (for MSW incineration only), and the costs included capital costs, financing costs, operations and maintenance (O&M) costs, capital replacement reserve fund, and hauling and disposal costs. As part of the simplified analysis, several key assumptions were made:

- Facilities were assumed to be constructed overnight, operational by 2027.
- Facilities were assumed to be fully financed with municipal bonds at a rate of 3.5% over 20 years.
- Facilities were assumed to capture their annual throughput instantaneously, and there was no growth in future tonnage.
- Hauling and disposal costs of initial rejects and ash were performed by the County with existing fleet vehicles.
- The analysis excludes the cost of any electrical upgrades that may be required.
- Future costs and revenues were assumed to escalate at a rate of 2% per year due to inflation.

Planning-level assumptions for capital cost, annual operations and maintenance (O&M) costs, and throughout capacities were developed for each facility type considered. Table 5 summarizes assumptions used in the modeling costs for the various facilities.

Table 5: Facility Cost Assumptions

Variable	Unit	Woody Biomass Facility	Modular MSW Incinerator Facility
Average Daily Throughput	tpd	178.1	65.8
Annual Throughput	Tons	65,000	24,000
Capital Cost	2026$	$28,282,664	$56,460,595
Annual Facility O&M Costs	2026$/year	$3,370,034	$1,290,338
Capital Replacement Reserve Fund	% of Capital Cost	2%	2%
Initial Reject Rate	% of inbound tons	0%	10%
Ash Generated	% of tons combusted	5%	10%
Hauling & Disposal Cost	$/ton	$48.82	$48.82
Fee Paid to Haulers to Bring Material to Facility	$/ton	$50	N/A

Key assumptions used to estimate revenue streams are noted in Table 6 summarizes assumptions used in the modeling costs for the facilities.

Table 6: Facility Revenue Assumptions

Variable	Unit	Woody Biomass Facility	Modular MSW Incinerator Facility
Gross Electricity Production	kWh/ton	650	650
Parasitic Load	%	13%	13%
Net Electricity Production	kWh/ton	566	566
Electricity Buyback Rate	$/MWh	$30.00	$30.00
Ferrous Metal Recovery	% of tons combusted	N/A	3%
Non-Ferrous Metal Recovery	% of tons combusted	N/A	0.4%
Scrap Ferrous Metal Sale Price	2026$/ton	N/A	$120.00
Scrap Non-Ferrous Metal Sale Price	2026$/ton	N/A	$820.00

Over the 20 year lifecycle of the study period, all revenues and costs were inflated to year of expenditure dollars and then discounted to present values using the weighted average cost of capital of 3.5%. After all cash flows were discounted into present value terms, key metrics were established including the net present value and the levelized cost per ton.

As shown in Table 7 below, the costs of the facility outweigh the anticipated revenue to be earned without any tipping fee revenue for the county. The levelized cost per ton presented, represents the additional revenue required per ton to breakeven at a site. While both facilities need additional revenues to breakeven, the cost of managing the material at one of these facilities should be compared against the cost of managing the material in the absence of the facility. For example, if on average, the cost to the County for managing MSW over the next 20 years is less than $209 per ton, the County may still see a return on the MSW incinerator facility, relative to a baseline or “do-nothing” case.

Table 7: Present Value of Cash Flows in 2026$, 2026-2046

Variable	Woody Biomass Facility	Modular MSW Incinerator Facility
Revenue from Sale of Electricity Generated	$18,345,210	$6,096,255
Revenue from Sale of Ferrous Metals Recovered	-	$3,892,883
Revenue from Sale of Nonferrous Metals Recovered	-	$1,178,645
Revenue from Tipping Fees	-$54,067,817[2]	-

[2] The negative tipping fee revenue indicates the cost associated with paying haulers to bring wood waste to the facility.

Variable	Woody Biomass Facility	Modular MSW Incinerator Facility
Total Revenues	**-$35,722,607**	**$11,167,782**
Debt Service	$27,326,245	$54,551,299
Hauling & Disposal of Initial Rejects	-	$1,949,177
Hauling & Disposal of Ash Generated	$2,302,748	$765,221
Facility O&M Costs	$56,394,092	$22,788,179
Total Costs	**$86,023,085**	**$80,053,876**
Net Present Value	**-$121,745,692**	**-$68,886,094**
Levelized Cost per Ton	**$136.40**	**$209.02**

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9 Planning, Permitting & Compliance

9.1 Land Use Approvals

Development of a biomass/waste-to-energy facility in Lincoln County will require compliance with local land use regulations administered by Lincoln County Planning Department and, where applicable, municipal jurisdictions and federal/state agencies. The Port Authority Mill site and the Stoken Rentals sites are both well-suited for industrial development. Land use approvals are a critical early step in project implementation. These approvals establish the allowable use, conditional requirements, and site-specific performance standards that govern facility design, construction, operations, and impact mitigation. Lincoln County regulates land use through growth policies, zoning ordinances, and subdivision regulations. Industrial energy and waste processing facilities are typically reviewed through one or more of the following mechanisms:

- Zoning Compliance Review to confirm that the proposed use is permitted outright or conditionally within the applicable zoning district.
- Conditional Use Permit (CUP) review for uses that may have site-specific impacts requiring individualized conditions.
    - MEPA - Environmental impact assessments, mitigation measures
        - Surveys, mitigation, timing windows.
        - Noise/Odor Controls - Modeling & mitigation
- Subdivision Review, if land division, boundary adjustments, or creation of new parcels is proposed.
- Floodplain, setback, and access compliance, including coordination with Montana Department of Transportation (MDT) for highway approaches where applicable.

Public notice, agency coordination, and opportunities for public comment are dependent components of the approval process for projects of this scale. A CUP provides discretionary review to ensure that the proposed facility activities are compatible with surrounding land uses, meets performance standards that protect public and environmental health, and impacts from facility operations have defined mitigation measures.

The Port Authority Mill site is subject to EPA institutional controls associated with the former Stimson Lumber and Libby Asbestos Operable Unit; land use approvals must be coordinated with the site's Operation and Maintenance (O&M) plan. This coordination requires confirmation that the proposed land uses are consistent with approved industrial reuse and remains in compliance with established restrictions or controls. These requirements are typically addressed in parallel with land use approvals and incorporated into CUP conditions.

9.2 Air Quality Permits

The project site presents a complex regulatory environment for air quality permitting. After discussion with the Lincoln County Environmental Health department, this process needs to ensure any impacts to air quality from facility operations will need to be mitigated to meet health standards; emission control technologies are available and can effectively mitigate emissions to comply with public/environmental health standards.

Project feasibility may be influenced by applicable air quality permitting requirements, including the potential need for air dispersion modeling to demonstrate compliance with federal, state, and local ambient air quality standards. Depending on project size, emissions profile, and location, modeling may be required to evaluate short- and long-term impacts from criteria pollutants and toxic air contaminants, including cumulative impacts from nearby existing sources. Localized meteorological conditions, such as wintertime inversion layers or complex terrain, may also need to be addressed to adequately characterize worst-case dispersion scenarios.

Permitting applicability will depend on whether the project triggers Prevention of Significant Deterioration (PSD) requirements or qualifies as a minor source under applicable thresholds. As such, air quality permitting considerations represent a potentially critical path item that may influence both project design and overall viability. Further evaluation by air quality specialists is recommended to confirm regulatory applicability, modeling scope, and permitting risk.

Key permitting challenges for the proposed facility include:

9.2.1 Dual Ambient Air Quality Standards

Montana's Ambient Air Quality Standards (MAAQS)[4] apply in addition to the federal National Ambient Air Quality Standards (NAAQS)[5], creating an added layer of compliance.

9.2.2 Local Non-Attainment Designations

The Libby area is designated non-attainment for state-level $PM_{2.5}$ and PM_{10} standards, which increases the scrutiny on new emission sources and limits permitting flexibility.

9.2.3 Local Fuel Restrictions

Lincoln County manages the air district program that places restrictions on the types of solid fuels that may be combusted. This threshold can be maintained through best available control technology to mitigate emissions.

9.2.4 Proximity to Multiple Class I Areas

There are several federally protected Class I areas within 100 kilometers of Libby/Eureka, including:

- Glacier National Park
- Flathead Indian Reservation
- Cabinet Mountains Wilderness (Kootenai National Forest)
- Cabinet Mountains Wilderness (Idaho Panhandle National Forest)
- Mission Mountain Wilderness Area

Class I areas trigger heightened regulatory protections. Land managers for these areas have authority to participate in the permitting process—particularly for facilities classified as "major sources" (potential emissions >100 tons/year). Their review commonly includes detailed modeling of air quality impacts and air-quality–related effects such as acidic deposition, particulate loading, and deposition of toxic metals (e.g., mercury,

hexavalent chromium, dioxins/furans). After discussion with Lincoln County, Class I areas do not have a high likelihood of impacting facility development feasibility.

9.3 Water/Stormwater/Wastewater Considerations[3]

9.3.1 Stormwater

Stormwater discharges are subject to aggressive federal/state enforcement and frequent citizen suits under the Clean Water Act. Accordingly, the sector is highly litigious, making rigorous, documented compliance management essential to reduce financial and operational risk. Montana DEQ administers stormwater under the Montana Pollutant Discharge Elimination System (MPDES); Libby does not operate its own MS4 program, so state permits are the controlling requirements, with City design standards applying to public works interface. Applicable guidelines for consideration include but are not limited to:

Construction Phase Coverage – Construction General Permit (CGP) Ground disturbance ≥ 1.0 acre, or <1 acre if part of a larger common plan that will disturb ≥1 acre

- Develop a project-specific SWPPP that identifies pollutant sources (e.g., exposed soils, concrete washout, fuels), erosion/sediment controls, good-housekeeping measures, construction sequencing, stabilization strategy, inspection/maintenance procedures, and site maps.
- Submit a Notice of Intent (NOI) electronically through DEQ's FACTS system (Fees, Applications & Compliance Tracking System) before breaking ground; pay applicable fees.
- Post the required public notice/sign at or near the site per permit conditions. (Montana added a public notice/sign requirement; current CGP includes notice provisions.)
- Implement BMPs from the SWPPP and maintain them through the project; update the SWPPP when site conditions or controls change[3]

Operations Phase – MPDES Multi-Sector General Permit for Industrial Stormwater

- NOI submittal via; identify all stormwater outfalls and receiving waters; pay applicable fees.
- Prepare Industrial SWPPP describing sources of pollution (e.g., fuel-oil receiving and storage, ash handling, chip piles), control/mitigation measures, inspection/monitoring schedules, training, annual reporting, and site mapping.
- Implement technology-based and water-quality-based BMPs such as good housekeeping, spill/leak prevention, exposure minimization, and sediment/source controls tailored to energy-generation and fuel handling operations.
- Monitoring and reporting
- Routine facility inspections and storm event inspections as specified in the permit.

[3] Montana Department of Environmental Quality (DEQ). (2024). Montana Pollutant Discharge Elimination System (MPDES) program overview. https://deq.mt.gov/water

- Analytical monitoring (sector-specific benchmarks) and, for certain sectors, indicator monitoring
- Annual Report submittal by Feb 28 each year, summarizing monitoring and SWPPP implementation.
- No Exposure Certification may be used if all industrial materials and activities are fully sheltered; otherwise, MSGP coverage is required.

9.4 Solid Byproduct Management

Ash and char residues generated at a WTE facility are typically removed from the site and transported to a permitted Class I landfill for disposal. During facility acceptance testing and early operations, an initial ash characterization study is performed to demonstrate that the ash residue meets non-hazardous waste criteria in accordance with applicable state and federal regulations.

As part of ongoing compliance, the ash is routinely tested using the Toxicity Characteristic Leaching Procedure (TCLP)[4] to confirm that regulated constituent concentrations remain below hazardous waste thresholds. TCLP testing is commonly conducted on a regular basis (e.g., monthly or quarterly, depending on permit requirements) to verify continued compliance throughout facility operations. pH is also monitored to ensure the ash remains within the acceptable range for disposal, which is typically alkaline (approximately pH 8–11) and suitable for typical MSW landfills. Montana DEQ designates these MSW landfills as Class II.

Once delivered to the landfill, the ash residue is commonly managed as part of daily cover operations or beneficially used on site as an alternative daily cover material where permitted. This practice helps reduce the need for virgin cover material and supports efficient landfill operations.

9.5 Grid Interconnection & Energy Offtake

9.5.1 Lincoln Electric Cooperative

Lincoln Electric Cooperative (LEC) is a rural cooperative in northwest Montana. Founded in 1948, they currently serve 5,216 members with 26 employees and service 1,013 miles of line within Lincoln County, mainly between Eureka and Whitefish, MT.

An interview was conducted with an Engineering Manager at LEC to inform electrical interconnection feasibility and market context for a potential waste-to-energy (WTE) facility in Lincoln County. Following the conversation, LEC graciously donated a project study, Appendix C, to evaluate the assumed parameters of a future WTE facility. The results of which are summarized as follows:

- Two sites considered: Eureka Industrial Park and Former Plum Creek Property Near Fortine

[4] United States Environmental Protection Agency. *Method 1311: Toxicity Characteristic Leaching Procedure*. U.S. Environmental Protection Agency, July 1992, https://www.epa.gov/sites/default/files/2015-12/documents/1311.pdf.

  - The preferred location analyzed was the former Plum Creek Timber property southeast of Fortine, connected via the existing J Feeder from the Trego Substation.
  - Plum Creek is ~ 4 miles from Trego substation. This is served entirely by overhead 3-PH distribution.
  - Eureka has mixed overhead and underground line configuration which creates interconnection challenges.

- The J Feeder can support the biomass project w/o requiring conductor or feeder upgrades. The existing feeder infrastructure has sufficient capacity to accommodate the plant's output.
- LEC determined that existing regulators at the Trego Substation would likely need upgrades to operate properly during reverse power flow events. This would be a system upgrade that would have cost implications.
- The analysis assumed the biomass generator supplied no reactive power (kVAR) because generator capability data was unavailable. This means pure unity on generation which is not the case. More than likely the TG will have a PF of 0.85 or 0.90 but there should be automatic voltage regulation to compensate for LEC's requirement of 90%.
- Any future interconnection study must include the generator's reactive power capability curve and voltage control characteristics.
- LEC's preliminary planning level cost estimate (2028) is $798,600. This is contingent on several factors that could be higher when LEC get's more information and timing is established.

Before moving forward, the study recommends:

- Providing detailed generator capability data and curves
- Completing formal LEC interconnection application
- Performing detailed engineering and protection studies.
- Completing a separate interconnection review w/ BPA

9.5.2 Flathead Electric Cooperative

Founded in 1937, Flathead Electric Cooperative (FEC) supplies and services over 5,000 miles of line within Flathead and Lincoln Counties, making it the largest Co-op and second largest energy utility in Montana.

A similar interview was conducted with various stakeholders / leadership at FEC to gain insights and feedback into the feasibility of a WTE facility in the region. FEC echoed similar sentiments regarding such a facility and confirmed an interest in the project along with its numerous benefits. While additional commitments or needs were not necessary at this time, FEC welcomes the conclusions of this feasibility study and is open to supporting additional efforts regarding the potential WTE project pending study review and future RFP outcomes.

9.5.3 Increased Public and Agency Scrutiny

Public hearings and comment periods will be required by both Lincoln County and Montana DEQ. Air permitting for a biomass to energy facility at this location will require coordination among state, local, and federal stakeholders, as well as proactive public outreach. The permitting timeline and level of technical analysis will be strongly influenced by the project's emission profile (tons/year) and its potential impacts on nearby Class I areas.

9.6 Funding Strategy Considerations

Municipal solid waste and biomass-to-energy projects are often financed through a layered capital structure that combines public and private funding sources, particularly for larger or municipally sponsored facilities. These projects typically rely on long-term disposal contracts ("tipping fee" agreements) and, where applicable, power purchase agreements (PPAs) to generate stable, bankable revenues based on energy export and/or capacity payments. However, financing approaches vary widely depending on project scale, ownership model, and revenue structure. Smaller or privately developed facilities may rely on simpler structures such as corporate financing, single-source debt, or grant-supported funding. That said, there are numerous ways to structure financing and ownership that can align with short-term and long-term goals of the County.

This revenue base supports debt financing such as municipal bonds, state revolving fund loans, or federal programs (e.g., infrastructure or energy grants and low-interest loans). Projects may also pursue public-private partnerships (P3s), where a private developer finances, builds, and operates the facility in exchange for capturing all revenue sources (e.g., processing, electrical offtake, metals recovery). Additional capital can be derived from environmental or renewable energy incentives, tax-advantaged financing (like tax-exempt bonds), and, in some jurisdictions, carbon or renewable energy credits tied to emissions reductions. Federal tax incentives, including investment or production tax credits, may further enhance project economics through transferability or direct pay provisions. Ultimately, successful funding strategies depend on securing regulatory approvals, demonstrating long-term feedstock supply, establishing stable contract-backed revenues, and aligning with policy priorities such as emissions reduction, waste diversion, forest health, wildfire mitigation, and rural economic development.

A project of this size, given its goals and anticipated benefits, has the potential to attract investment from a range of organizations and industries; however, experience with similar projects suggests that private and market-based funding alone may not fully meet capital requirements, and some level of public-sector support or subsidy is often needed to achieve financial viability.

Potential funding / grant opportunities include but are not limited to:

- Climate Smart Communities
- New Markets Tax Credits (NMTC)
- USDA Rural Development / USDA Forest Service Wood Innovation Program
- Wood Products Infrastructure Assistance Grant
- National Forest Foundation Grants
- HUD Exchange

- SRF Loan
- Montana Forest Action Plan – MT/DNRC
- Collaborative Forest Management Support Grants
- Workforce, Technology, and Sustainable Wood Products Grants
- Landscape Scale Restoration Grants - DNRC
- Hazardous Fuels Reduction – DNRC
- Forest Pest Management – DNRC
- Community Wildfire Defense Grant Program - DNRC
- DNRC RRG Planning (2027)
- State / Federal
    - Inflation Reduction Act Programs (Investment Credit/Product Tax Credit) / BBB
    - DOE Bioenergy Technologies Office (BETO) Funding Opportunities
    - DOE Waste-to-Energy Technical Assistance Program (NREL/BETO)
    - DOE Vehicle & Bioenergy joint funding (waste-to-energy, fuels, CHP)
    - DOE Loan Programs Office (LPO)
    - EPA Solid Waste Infrastructure for Recycling (SWIR) Grants
    - Montana DEQ Energy Programs
    - Rural Business Development Grants (RBDG)
    - Business & Industry (B&I) Loan Guarantees
    - Community Facilities Loan & Grant Program
    - Advanced Biofuel Payment Program
    - Intermediary Relending Program (IRP)
- Utility Partnerships / Cost-Sharing

Recent federal legislation, including updates under the Inflation Reduction Act (IRA) and subsequent policy changes in the One Big Beautiful Bill (OBBB), provides several tax credit mechanisms that may enhance the financial viability of WTE projects. These include Section 45Z Clean Fuel Production Tax Credit for fuels derived from organic waste streams, as well as the technology-neutral Section 45Y Clean Electricity Production Tax Credit (PTC) and Section 48E Investment Tax Credit (ITC), both of which can apply to qualifying waste energy recovery facilities. Eligibility for these incentives depends on meeting stringent lifecycle greenhouse gas emission requirements—generally requiring net-zero or lower emissions—which may necessitate high-efficiency systems or carbon mitigation measures. Credit value and availability are also time-sensitive, with full benefits available for projects that begin construction before established phase-down deadlines (end of 2033), after which incentive levels decline (2034 ~ 75% credit; 2025 ~ 50%; 2036 and beyond ~ 0%). Additional provisions, such as domestic content requirements and restrictions on certain foreign involvement, will further influence eligibility and credit value. Collectively, these incentives can represent a significant component of project financing but require careful evaluation based on technology selection, feedstock characteristics, and project timing.

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10 Recommendations and Conclusions

Based on the site evaluations, feedstock assessments, technology review, infrastructure constraints, and preliminary lifecycle financial modeling completed as a part of this study, HDR concludes that Lincoln County has a viable long-term opportunity to develop a regional biomass-to-energy program centered primarily around woody biomass utilization, with future optional integration of municipal solid waste thermal processing.

Sites

The study determined that the Port Authority Mill Site in Libby and the Stoken Rentals Site near Fortine represent the most feasible locations for future development due to their industrial histories, transportation access, available acreage, feedstock proximity, and compatibility with utility and infrastructure requirements. Of these sites, the Port Authority Mill Site offers the strongest long-term strategic advantage because of its existing industrial infrastructure, substation access, rail connectivity, available utility corridors, and compatibility with future phased expansion.

Technologies

From a technology perspective, the assessment determined that commercially proven grate-based direct-combustion systems present the lowest-risk and most technically feasible path for Lincoln County. While several thermal conversion technologies were reviewed, including gasification and pyrolysis, these technologies continue to demonstrate limited commercial deployment with a heterogeneous feedstock, and generally require higher levels of fuel preprocessing. Additionally, many advanced thermal conversion technologies lack long-term operational references for processing heterogeneous waste streams under conditions comparable to those anticipated in Lincoln County.

Accordingly, grate-based direct combustion systems remain the most mature and operationally proven technologies available for biomass and MSW thermal combustion. The two major categories of direct combustion systems are reciprocating grate and travelling grate systems.

Reciprocating grate direct combustion systems offer the greatest flexibility for processing heterogeneous feedstocks and have demonstrated strong long-term reliability throughout North America and Europe. These systems are robust and capable of handling variable fuel heating values, moisture content, and inconsistent sizing. They are also supported by robust air pollution control systems and operational practices.

Traveling grate direct combustion systems also performed favorably in the evaluation, particularly where the primary fuel source consists of a relatively homogeneous woody biomass. However, even a homogenous feedstock would still need to be preprocessed (chipped and sized) before it is introduced into the boiler. This system is lacking if MSW were to be introduced in the future, in which case an extensive MSW preprocessing system would be required to produce a refuse-derived fuel (or “RDF”) for combustion in this style boiler.

Fluidized bed technologies are potentially effective for properly prepared woody biomass or refused derived fuels but are very sensitive to consistent sizing of the fuel and alkalinity. Heavy MSW components such as glass, metals, grit, and inert materials can create operational challenges in fluidized systems, including agglomeration or clinker formation. Similarly, suspension-fired systems require extensive preprocessing and drying of the feedstock to maintain a highly consistent fuel so it can be combusted in suspension; this limits their practicality in mixed-feedstock applications.

The study further concludes that co-mingling woody biomass and MSW within a single combustion process presents technical and operational challenges that must be carefully considered. While some grate-based systems are capable of handling blended fuels, these technologies are generally optimized for either MSW feedstocks or biomass feedstocks, not a high-volume blend of both. Woody biomass combusts more rapidly and consistently than MSW, has lower ash content, and typically generates more stable combustion conditions. MSW, by comparison, is more heterogeneous than biomass, contains elevated moisture and inert content, and produces significantly more ash residue. Blending these two fuels can create combustion instability, incomplete burnout, fouling, clinker or glassing formation which can all lead to grate performance issues. Additionally, co-mingling combustion would increase complexity surrounding ash characterization, disposal requirements, and metals recovery.

Phased Development

For these reasons, HDR recommends that Lincoln County utilize a phased development strategy rather than pursuing an immediate fully integrated co-mingled MSW/biomass combustion system. Phase 1 development should focus on a direct-combustion biomass facility utilizing a proven grate-based system supplied by regional forest residues, and logging slash.

A future Phase 2 development strategy could evaluate modular MSW combustion technologies once regional waste volumes, funding mechanisms, and regulatory pathways become more clearly established. Modular systems provide advantages for Lincoln County because they can be deployed incrementally in smaller processing trains, allowing the County to scale infrastructure with actual waste generation volumes while minimizing initial capital exposure. This phased approach also preserves optionality for future policy changes, landfill constraints, regional partnerships, and utility market opportunities.

Financing

The high-level financial modeling performed as part of this study indicates that both woody biomass and modular MSW conversion systems would require additional revenue support beyond energy sales alone to achieve lifecycle breakeven conditions. Preliminary modeling assumptions included municipal bond financing at 3.5% over 20 years, 2% annual escalation, full facility utilization beginning in 2027, and power sales at approximately $30/MWh. Under these assumptions, the woody biomass facility was estimated at approximately $28 million in capital cost with annual throughput of roughly 65,000 tons per year, while the modular MSW facility exceeded $56 million in estimated capital cost for roughly 24,000 tons annually.

The analysis demonstrates that electricity revenues alone are insufficient to support project economics at the facility scales evaluated. However, this outcome is consistent with many successful biomass and waste-to-energy projects nationwide, where project viability depends on layered revenue sources and public-sector partnership structures. Successful projects are typically financed using combinations of:

- Municipal or tax-exempt bond financing
- Federal and state grant programs
- Public-private partnerships (P3 delivery models)
- Long-term waste supply agreements
- Renewable energy credits (RECs)
- Power purchase agreements (PPAs)
- Carbon reduction incentives
- USDA Wood Innovation Grants
- Infrastructure and community resilience grants
- Economic development district financing tools
- Tipping fee revenues
- Forest restoration funding programs

Lincoln County Advantages

Lincoln County possesses several advantages that improve competitiveness for future project funding, including the recently established Master Stewardship Agreement with the USFS, participation in Good Neighbor Authority programs, identified wildfire mitigation objectives, Federal Forest restoration priorities, and the Libby Bioeconomy Development Opportunity Zone designation. These programs strengthen the County's ability to pursue external grant funding and attract development partners by demonstrating long-term feedstock reliability and policy alignment.

Project Benefits

Importantly, the value proposition of a biomass-to-energy facility within Lincoln County extends beyond direct electricity generation revenues alone. Broader economic and environmental benefits include:

- Reduction in slash pile burning and associated particulate emissions
- Wildfire fuel-load reduction
- Extension of landfill life
- Increased energy resiliency
- Job creation
- Improved utilization of low-value forest residues currently considered waste

Conclusion

Overall, HDR concludes that Lincoln County is well-positioned to advance a phased woody biomass-to-energy strategy centered initially on direct-combustion biomass systems at the Port Authority Mill site while planning a phased approach for future modular MSW integration. This approach represents the lowest technical risk, strongest alignment with regional infrastructure realities, and the most achievable pathway for successful funding, permitting, and long-term operational viability

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11 References

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[3] United States Environmental Protection Agency. *Method 1311: Toxicity Characteristic Leaching Procedure*. U.S. Environmental Protection Agency, July 1992,
[4].Montana Administrative Rules (ARM), *Title 17, Chapter 8, Subchapter 2 – Ambient Air Quality*, ARM 17.8.201–17.8.230.
[5].U.S. Environmental Protection Agency (EPA), *National Ambient Air Quality Standards*, 40 CFR Part 50

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Appendix A. Master Stewardship Agreement

FS Agreement No. 24-SA-11011400-025

Cooperator Agreement No. _____

MASTER
STEWARDSHIP AGREEMENT
Between The
COUNTY OF LINCOLN
And The
USDA, FOREST SERVICE
KOOTENAI NATIONAL FOREST

This Master Stewardship Agreement is hereby made and entered into by and between the County of Lincoln, hereinafter referred to as "County," and the United States Department of Agriculture (USDA), Forest Service, Kootenai National Forest, hereinafter referred to as the "Forest Service," under the authority and provisions of the Agricultural Act of 2014, Pub. L. 113-79, sec. 8205.

Background: In 2003 Congress authorized the Forest Service and the Bureau of Land Management to enter into stewardship contracts and agreements "to achieve land management goals for the national forests that meet local and rural community needs." The primary focus of this legislation is to achieve land management goals through stewardship projects awarded under contracts or agreements. Unique to the legislation is the ability to exchange goods for services that meet the land management objectives.

The spatial extent of this Master Stewardship Agreement includes all Kootenai National Forest lands contained within Lincoln County, Montana, which totals approximately 2.29 million acres. Lincoln County and the Kootenai National Forest will prioritize the landscape to determine priority acres that will be treated under the framework of this master stewardship agreement.

Lincoln County is one of the most heavily forested counties in the West. The State of Montana has classified nearly 99% of the private lands within the County as forested. The Kootenai National Forest comprises 74% of the County's land mass, and when combined with state and industrial timber lands, nearly 80% of lands within Lincoln County are forest. Agency and industrial timber lands, in some cases, are within less than a mile from city limits. Other facts related to wildfire risks to Lincoln County, its residents, private property and critical infrastructure are as follows:

- The 2020 Montana Forest Action Plan (MFAP) data identifies Lincoln County as having the most "at risk acres" from wildfire, at 407,552 acres. There are an additional 54,037 acres at risk from forest health issues and 68,870 acres from combined risk for a total of 530,459 acres.

- The June 14, 2022, Headwaters Economics study "A Profile of Wildfire Risk" places 63% of Lincoln County homes at risk of wildfire from direct ignition sources and 37% from indirect sources, meaning 100% of homes are exposed to wildfire risk, well above the national average of 67%.

- Based upon the September 2019 "Profile of Development and the Wildland Urban Interface Study" Lincoln County ranks in the 97th and 98th percentile of all western counties in existing and potential fire risk, respectively. The study reveals that Lincoln County has the largest total WUI area of any western county, 394 square miles. Lincoln County has the highest share of homes built inside the WUI (50.7%) and the highest number of second homes inside the WUI (24.1%). These are much higher than the averages of counties within the western United States at 7% and 15.1%, respectively.

- In April 2014, Governor Bullock designated 1,449,997 (67%) acres on the Kootenai National Forest as the Montana Priority Forest Landscapes initiative through the 2014 U.S. Farm Bill. A significant amount of those acres lies within the WUI.

- 10,000 acres of the at-risk forested lands, as determined by the MFAP, lie within the Libby Superfund site, Operable Unit #3 (OU#3), or the vermiculite mine site. While underlying asbestos issues may require the utilization of specialty harvesting/ management practices, these underlying issues do not negate but, rather, elevate the need to manage these lands for public safety and improved forest resilience.

- As a result, the USFS designated the Kootenai Complex, including substantial portions of the Kootenai National Forest, as one of the first 10 Priority Treatment Landscapes for implementing the 10-Year Strategy and prioritizing funds from the Bipartisan Infrastructure Law and the Inflation Reduction Act.

- In the designation, the Forest Service recognized that recent cutting-edge wildfire science confirms that Lincoln County, MT, communities are at a particularly high risk of being impacted by severe wildfire events.

Title: Master Stewardship Agreement for Kootenai National Forest Lands Located in Lincoln County Montana

I. PURPOSE:

The purpose of this Master Stewardship Agreement is to document the cooperative effort between the parties for landscape restoration activities within the Kootenai National Forest on areas within the Lincoln County wildland urban-interface, as identified in the 2023 Community Wildfire Protection Plan, Exhibit A, and in accordance with the following provisions and the hereby incorporated Template for Stewardship Supplemental Project Agreement (SPA), attached as Exhibit B.

II. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

The Forest Service is a land management agency dedicated to the wise use and management of National Forest System (NFS) lands, including the responsibility for maintaining and improving resource conditions.

The mission of the U.S. Forest Service is to sustain the health, diversity, and productivity of the nation's forests and grasslands for present and future generations. Additionally, coordinating with Tribal, State, and local governments to mitigate catastrophic threats to our communities and human health has come to the forefront. The Confronting the Wildfire Crisis 10-year strategy calls for: 1) Treating up to an additional 20 million acres on the National Forest System in the West, over and above current treatment levels; 2) Treating up to an additional 30 million acres on other Federal, State, Tribal and private lands in the West; and 3) Developing a plan for long-term maintenance beyond 10 years. To implement this strategy, Chief Moore developed an April 25th, 2022, policy letter that states, in part, "Our strategy---built in close coordination with Federal, State, and Tribal governments and non-governmental partners, communities, and stakeholders---is focused on work in the highest priority locations to protect communities." The area addressed in this Master Stewardship Agreement is the area known as the Lincoln County Wildland Urban Interface (WUI) as identified in the Lincoln County Community Wildfire Protection Plan (CWPP). The area captures portions of the Libby, Three Rivers, and Rexford Ranger Districts.

The stewardship projects developed under this MSA will be for the purpose of protecting priority Lincoln County communities, identified in the 2023 CWPP, from the effects of wildfire while also meeting at least one of the seven following goals contained in the Healthy Forest Restoration Act, which include:

1. Road and trail maintenance or decommissioning to restore or maintain water quality.
2. Soil productivity, habitat for wildlife and fisheries, or other resource values.
3. Setting of prescribed fires to reduce wildfire hazards; improve the composition, structure, condition and health of stands; or improve wildlife habitat.
4. Removing vegetation or other activities to promote healthy forest stands, reduce wildfire hazards, or achieve other land management objectives.
5. Watershed restoration and maintenance.
6. Restoration and maintenance of wildlife and fish habitat.
7. Control of noxious weeds and exotic weeds, and re-establishment of native plant species.

Lincoln County will utilize the County Firesafe Council to prioritize projects for Kootenai National Forest approval in accordance with a Memorandum of Understanding with the Firesafe Council. The county will coordinate the development of the individual SPAs with assistance from Montana DNRC and USFS personnel.

Additionally, Lincoln County will work with the Lincoln County Port Authority to assist in SPA development and administration of SPAs under this Agreement.

This Master Stewardship Agreement will provide an opportunity for the parties to seek funding to expand partnership opportunities, and to garner new and additional support from partners, including but not limited to the timber industry, Federal and non-Federal entities, tribal entities, and County's members and volunteers. Mission accomplishment for both parties will be furthered by the restoration of natural resources across the landscape.

All projects conceived under this Master Stewardship Agreement will undergo a collaborative process to determine specific habitat improvements. The collaborative process will ensure that the benefits of undertaking restoration activities are mutually beneficial to County and the Forest Service as well as being beneficial to a wide diversity of interests involved in collaboration.

Both parties share an interest in improving the ecosystem condition and function of the landscape. A healthy landscape provides a variety of benefits beyond the needs of a single species, and therefore benefits both parties.

It is therefore mutually beneficial for the parties to work together to implement landscape restoration and enhancement projects.

In consideration of the above premises, the parties agree as follows:

III. THE PARTNER SHALL:

A. LEGAL AUTHORITY. The County shall have the legal authority to enter into this Master Stewardship Agreement, and the institutional, managerial, and financial capability to ensure proper planning, management, and completion of the project, which includes funds sufficient to pay the nonFederal share of project costs, when applicable.

B. Explore opportunities for additional support from other parties for projects associated with this Master Stewardship Agreement.

C. Coordinate with agencies, contractors, and organizations in the implementation of project work associated with this Master Stewardship Agreement.

D. Coordinate with the U.S. Forest Service to develop Supplemental Project Agreements (SPAs) under this master agreement.

E. Identify qualified personnel or contractors to implement tasks identified in SPAs under this Master Stewardship Agreement, including coordinating and completing design, NEPA, and preparation that is agreeable by the U.S. Forest Service and required for projects occurring on National Forest Systems lands, including, but not limited to, property boundary surveys and designating treatment unit boundaries.

F. Inform the U.S. Forest Service of any revisions made to the 2023 CWPP, Exhibit A. Any revisions made to the 2023 CWPP may be incorporated into this agreement without a formal modification.

G. Provide a Project Liaison as the primary representative and main contact for the U.S. Forest Service for all project work conducted under this agreement. The Project Liaison should have the ability to direct contractors to ensure that projects are completed to U.S. Forest Service specifications and that projects are completed safely, timely, and meet high quality and quantity standards.

IV. THE U.S. FOREST SERVICE SHALL:

A. Have the Regional Forester, or authorized designee, approve all stewardship project proposals.

B. Complete all necessary National Environmental Policy Act (NEPA) requirements.

C. Inform County of any changes in stewardship policy, law and regulations.

D. Recognize County's contribution, in a manner acceptable to both parties, in news releases, interpretive signs, photographs, or other media as appropriate.

E. Assist Lincoln County in the development of SPAs under this agreement.

F. When entering into a SPA, use the most recent stewardship agreement SPA template, FS-1500-21A and include the appropriate performance and/or financial monitoring provisions according to the current policy. See Exhibit B for current templates (Exhibit B.1 (with timber removal) and Exhibit B.2 (without timber removal.)) This exhibit can be updated without a formal modification.

G. Provide a Project Liaison who can act as the primary representative and main contact for the U.S. Forest Service for all project work under this agreement.

H. Coordinate and complete design, layout, and preparation not conducted by Lincoln County that is required for project work occurring on the National Forest System lands, including, but not limited to, property boundary surveys and designating treatment unit boundaries.

I. Explore opportunities for additional support for projects associated with this Master Stewardship Agreement.

V. IT IS MUTUALLY AGREED AND UNDERSTOOD BY AND BETWEEN THE PARTIES THAT:

A. PRINCIPAL CONTACTS. Individuals listed below are authorized to act in their respective areas for matters related to this Master Stewardship Agreement.

Principal U.S. Forest Service Contacts:

U.S. Forest Service Stewardship Coordinator	U.S. Forest Service Grants & Agreements Contact
Bruce Schuelke R1, Stewardship Coordinator 1820 Meadowlark Lane Butte, MT 59701 406-494-0269 bruce.schuelke@usda.gov	Carolyn Dexter R1, Grants Management Specialist 3232 West Nursery Road Coeur d'Alene, ID 83815 208-996-1006 carolyn.dexter@usda.gov
U.S. Forest Service Cooperator Program Contact	
Matthew Bienkowski Kootenai National Forest Partnership Coordinator 31374 U.S. Highway 2 Libby, MT 59923 406-283-7681 matthew.bienkowski@usda.gov	

Principal Partner Contacts:

County Stewardship Coordinator	County Administrative Contact
Brent Teske Lincoln County Commisioner 512 California Ave. Libby, MT 59923 406-334-6119 bteske@libby.org	Same as County Stewardship Coordinator Contact

B. ASSURANCE REGARDING FELONY CONVICTION OR TAX DELINQUENT STATUS FOR CORPORATE ENTITIES. This agreement is subject to the provisions contained in the Department of Interior, Environment, and Related Agencies Appropriations Act, 2012, P.L. No. 112-74, Division E, Section 433 and 434 regarding corporate felony convictions and corporate Federal tax delinquencies. Accordingly, by entering into this agreement County acknowledges that it: 1) does not have a tax delinquency, meaning that it is not subject to any unpaid Federal tax liability that has been

assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, and (2) has not been convicted (or had an officer or agent acting on its behalf convicted) of a felony criminal violation under any Federal law within 24 months preceding the agreement, unless a suspending and debarring official of the United States Department of Agriculture has considered suspension or debarment is not necessary to protect the interests of the Government. If County fails to comply with these provisions, the Forest Service will annul this agreement and may recover any funds County has expended in violation of sections 433 and 434.

C. AVAILABILITY FOR CONSULTATION. Both parties will make themselves available at mutually agreeable times, for continuing consultation to discuss the conditions covered by this Master Stewardship Agreement and agree to actions essential to fulfill its purposes.

D. ANNUAL MEETING. At a minimum, the parties will meet annually to discuss potential stewardship projects and jointly review the active stewardship project proposal list.

E. SUPPLEMENTAL PROJECT AGREEMENTS. Nothing in this Master Stewardship Agreement obligates either party to offer or accept any project proposals under this Master Stewardship Agreement. Any projects added to this Master Stewardship Agreement must be by mutual consent of the parties through a specific SPA. At a minimum, an SPA must:

1. Include language stating that the SPA will be made a part of this Master Stewardship Agreement thereby subjecting it to the terms of this Master Stewardship Agreement.
2. Include a map and description of the project area, treatment activities and corresponding treated acres, and other activities which may include other resource related projects.
3. Specify a method of designating trees for removal.
4. Describe the desired end result of the project(s).
5. Specify the exchange of goods for services. The Forest Service may apply the value of timber or other forest products removed as an offset against the cost of services received by County.
6. Designate a Forest Service and County official to monitor their respective responsibilities outlined in the SPA.
7. Include a Financial Plan to identify each parties contributions for projects identified in the SPA.
8. Identify appropriate bonding requirements.
9. Include any necessary forest restrictions and closure dates to allow County to implement and complete the project(s) within the specified timeframes.
10. Provide necessary direction to County to ensure compliance with appropriate laws and regulations to fulfill the terms of the SPA.
11. Identify any reporting requirements.
12. Be reviewed and approved by a delegated timber contracting officer when forest products will be disposed.
13. Be reviewed and approved by a Forest Service Grants Management Specialist.

14. Be mutually agreed to, in writing, by both parties and executed by the designated Forest Supervisor.

F. PERFORMANCE. The parties will perform in accordance with the approved SPAs.

G. EXCHANGE OF GOODS FOR SERVICES. SPA(s) may be completed where Forest Service goods are exchanged for County's services; Forest Service funds are exchanged for County's services; or a combination thereof.

H. TECHNICAL AND COST EVALUATION. Best approach determination is the evaluation method used by the Forest Service to approve stewardship agreement technical proposals. Such consideration shall primarily consider criteria other than cost. These non-price criteria include, but are not limited to:

1. The extent of mutual interest and benefit.
2. The advantages and effectiveness of mutual participation.
3. Joint expertise.
4. Past performance.
5. Technical approach.
6. Factors relevant to cost such as volunteer participation, contribution from other parties, cost sharing, etc.
7. Ability to utilize, educate and/or train a local workforce.
8. Benefits to the local community.
9. Ability to complete work in a timely manner.
10. Experience in performing similar work.
11. Ability to conduct work in an environmentally sound manner.

I. METHODS OF APPRAISAL. The value of timber and other forest products shall be determined using Forest Service standard guidelines, methods and techniques.

J. NOTICES. Any communications affecting the operations covered by this agreement given by the Forest Service or County is sufficient only if in writing and delivered in person, mailed, or transmitted electronically by e-mail or fax, as follows:

To the Forest Service Program Manager, at the address specified in this Master Stewardship Agreement.

To County, at County's address shown in this Master Stewardship Agreement or such other address designated within this Master Stewardship Agreement.

Notices will be effective when delivered in accordance with this provision, or on the effective date of the notice, whichever is later.

K. PARTICIPATION IN SIMILAR ACTIVITIES. This Master Stewardship Agreement in no way restricts the Forest Service or County from participating in similar activities with other public or private agencies, organizations, and individuals.

L. ENDORSEMENT. Any of County's contributions made under this Master Stewardship Agreement do not by direct reference or implication convey Forest Service endorsement of County's products or activities.

M. NON-FEDERAL STATUS FOR COOPERATOR PARTICIPANTS. The County agree(s) that any of County's employees, volunteers, and program participants shall not be deemed to be Federal employees for any purposes including Chapter 171 of Title 28, United States Code (Federal Tort Claims Act) and Chapter 81 of Title 5, United States Code (OWCP), as County has hereby willingly agreed to assume these responsibilities.

Further, County shall provide any necessary training to County's employees, volunteers, and program participants to ensure that such personnel are capable of performing tasks to be completed. The County shall also supervise and direct the work of its employees, volunteers, and participants performing under this agreement.

N. MEMBERS OF U.S. CONGRESS. Pursuant to 41 U.S.C. 22, no member of, or delegate to, Congress shall be admitted to any share or part of this Master Stewardship Agreement, or benefits that may arise therefrom, either directly or indirectly.

O. DRUG-FREE WORKPLACE.

1. The County agree(s) that it will publish a drug-free workplace statement and provide a copy to each employee who will be engaged in the performance of any project/program that receives Federal funding. The statement must

   a. Tell the employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in its workplace;

   b. Specify the actions County will take against employees for violating that prohibition; and

   c. Let each employee know that, as a condition of employment under any award, the employee:

      (1) Shall abide by the terms of the statement, and

      (2) Shall notify you in writing if he or she is convicted for a violation of a criminal drug statute occurring in the workplace, and must do so no more than five calendar days after the conviction.

2. The County agree(s) that it will establish an ongoing drug-free awareness program to inform employees about

   a. The dangers of drug abuse in the workplace;

b. The established policy of maintaining a drug-free workplace;

c. Any available drug counseling, rehabilitation and employee assistance programs; and

d. The penalties that you may impose upon them for drug abuse violations occurring in the workplace.

3. Without the Program Manager's expressed written approval, the policy statement and program must be in place as soon as possible, no later than the 30 days after the effective date of this Master Stewardship, or the completion date of this Master Stewardship Agreement, whichever occurs first.

4. The County agree(s) to immediately notify the Program Manager if an employee is convicted of a drug violation in the workplace. The notification must be in writing, identify the employee's position title, the SPA number of each project which the employee worked. The notification must be sent to the Program Manager within ten calendar days after County learn(s) of the conviction.

5. Within 30 calendar days of learning about an employee's conviction, County shall either:

a. Take appropriate personnel action against the employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973 (29 USC 794), as amended, or

b. Require the employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for these purposes by a Federal, State or local health, law enforcement, or other appropriate agency.

P. NONDISCRIMINATION. The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, and so forth.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Q. ELIGIBLE WORKERS. The County shall ensure that all employees complete the I-9 form to certify that they are eligible for lawful employment under the Immigration and

Nationality Act (8 USC 1324a). The County shall comply with regulations regarding certification and retention of the completed forms. These requirements also apply to any contract or supplemental agreement awarded under this Master Stewardship Agreement.

R. STANDARDS FOR FINANCIAL MANAGEMENT.

1. Financial Reporting

The County shall provide complete, accurate, and current financial disclosures of the project or program in accordance with any financial reporting requirements, as set forth in the financial provisions.

2. Accounting Records

The County shall continuously maintain and update records identifying the source and use of funds. The records shall contain information pertaining to the agreement, authorizations, obligations, unobligated balances, assets, outlays, and income.

3. Internal Control

The County shall maintain effective control over and accountability for all Forest Service funds. The County shall keep effective internal controls to ensure that all United States Federal funds received are separately and properly allocated to the activities described in the agreement and used solely for authorized purposes.

4. Source Documentation

The County shall support all accounting records with source documentation. These documentations include, but are not limited to, cancelled checks, paid bills, payrolls, contract documents. These documents must be made available to the Forest Service upon request.

5. Advance Payments

When applicable, County shall establish and maintain specific procedures to minimize the time elapsing between the advance of Federal funds and their subsequent disbursement.

S. INDIRECT COST RATES- PARTNERSHIP. Indirect costs are approved for reimbursement or as a cost-share requirement and have an effective period applicable to the term of this agreement.

1. If the Cooperator has never received or does not currently have a negotiated indirect cost rate, they are eligible for a de minimis indirect cost rate up to 10 percent of modified total direct costs (MTDC). MTDC is defined as all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel, and up to

the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award).

2. For rates greater than 10 percent and less than 25 percent, the Cooperator shall maintain documentation to support the rate. Documentation may include, but is not limited to, accounting records, audit results, cost allocation plan, letter of indirect cost rate approval from an independent accounting firm, or other Federal agency approved rate notice applicable to agreements.

3. For a rate greater than 25 percent, the U.S. Forest Service may require that the Cooperator request a federally approved rate from the Cooperator's cognizant audit agency no later than 3 months after the effective date of the agreement. The Cooperator will be reimbursed for indirect costs or allowed to cost-share at the rate reflected in the agreement until the rate is formalized in the negotiated indirect cost rate (NICRA) at which time, reimbursements for prior indirect costs or cost-sharing may be subject to adjustment.

4. Failure to provide adequate documentation supporting the indirect cost rate, if requested, could result in disallowed costs and repayment to the U.S. Forest Service.

T. OVERPAYMENT. Any funds paid to The County in excess of the amount entitled under the terms and conditions of this agreement constitute a debt to the Federal Government. The following must also be considered as a debt or debts owed by the Cooperator to the Forest Service:

- Any interest or other investment income earned on advances of agreement funds; or

- Any royalties or other special classes of program income which, under the provisions of the agreement are required to be returned.

If this debt is not paid according to the terms of the bill for collection issued for the overpayment, the Forest Service may reduce the debt by:

1. Making an aministrative offset against other requests for reimbursement.
2. Withholding advance payments otherwise due to The County.
3. Taking other action permissed by statute (31 U.S.C. 3716 and 7 CFR, Part 3, Subpart B).

Except as otherwise provided by law, the Forest Service may charge interest on an overdue debt.

U. AGREEMENT CLOSEOUT. Within 120 days after expiration or notice of termination the parties shall close out the award/agreement.

Any unobligated balance of cash advanced to the Cooperator must be immediately refunded to the Forest Service, including any interest earned in accordance with 7CFR3016.21/2CFR

215.22.

Within a maximum of 120 days following the date of expiration or termination of this grant, all financial performance and related reports required by the terms of the agreement must be submitted to the Forest Service by the Cooperator.

If this agreement is closed out without audit, the Forest Service reserves the right to disallow and recover an appropriate amount after fully considering any recommended disallowances resulting from an audit which may be conducted later.

V. PROGRAM MONITORING AND PROGRAM PERFORMANCE REPORTS. The parties to this agreement shall monitor the performance of the agreement activities to ensure that performance goals are being achieved.

Performance reports must contain information on the following:

- A comparison of actual accomplishments to the goals established for the period. Wherever the output of the project can be readily expressed in numbers, a computation of the cost per unit of output, if applicable.

- Reason(s) for delay if established goals were not met.

- Additional pertinent information.

The County shall submit annual performance reports to the U.S. Forest Service Program Manager. These reports are due 90 days after the reporting period. The final performance report must be submitted either with County's final payment request, or separately, but not later than 120 days from the expiration date of the agreement.

W. USE OF FOREST SERVICE INSIGNIA. In order for County to use the Forest Service insignia on any published media, such as a Web page, printed publication, or audiovisual production, permission must be granted by the Forest Service's Office of Communications (Washington Office). A written request will be submitted by Forest Service Region/Station/Area to the Office of communication Assistant Director, Visual Information and Publishing Services prior to use of the insignia. The Forest Service Region/Station/Area will notify The County when permission is granted.

X. RETENTION AND ACCESS REQUIREMENTS FOR RECORDS. The County shall retain all records pertinent to this Master Stewardship Agreement for a period of no less than three years from the expiration or termination date. As used in this provision, records include books, documents, accounting procedures and practice, and other data, regardless of the type or format. The County shall provide access and the right to examine all records related to this Master Stewardship Agreement to the Forest Service Inspector General, or Comptroller General or their authorized representative. The rights of access in this section must not be limisted to the required retention periond but must last as long as records are

kept.

If any litigation, claim, negotiation, audit, or other action involving the records has been started before the end of the 3-year period, the records must be kept until all issues are resolved, or until the end of the regular 3-year period, whichever is later.

Records for nonexpendable property acquired in whole or in part, with Federal funds shall be retained for 3 years after its final disposition.

Y. FREEDOM OF INFORMATION ACT (FOIA). Public access to Master Stewardship Agreement records must not be limited, except when such records must be kept confidential and would have been exempted from disclosure pursuant to "Freedom of Information" regulations (5 U.S.C. 552).

Public access to culturally sensitive data and information of Federally-recognized Tribes may also be explicitly limited by P.L. 110-234, Title VIII Subtitle B §8106 (2008 Farm Bill).

Z. TRAINING, EVALUATION, AND CERTIFICATION OF SAWYERS USED BY COOPERATORS. Any employee or volunteer of the cooperator who will use chain saws or crosscut saws on National Forest System lands under this agreement must be trained, evaluated, and certified in accordance with Forest Service Manual 2358. The cooperator is responsible for providing sawyer training, evaluation, and certification for the cooperator's employees and volunteers, unless the U.S. Forest Service and the cooperator determine it is not in the best interest of the partnership for the cooperator to provide sawyer training and evaluation. In these circumstances, the U.S. Forest Service, upon request and upon availability of Agency resources, may assist with conducting sawyer training and evaluation for the cooperator's employees and volunteers. Cooperator employees and volunteers who will use chain saws and/or crosscut saws on National Forest System lands must be certified by the cooperator. Only those cooperator organizations with an approved sawyer training, evaluation, and certification program may conduct sawyer training, evaluation, and certification. Any employee or volunteer of the cooperator who will use other types of saws, such as handsaws to cut small diameter material, brush saws, and pole saws, must be trained in accordance with Forest Service Handbook 6709.12, Chapter 40, section 41.3. The cooperator is responsible for providing that training.

AA. TEXT MESSAGING WHILE DRIVING. In accordance with Executive Order (EO) 13513, "Federal Leadership on Reducing Text Messaging While Driving," any and all text messaging by Federal employees is banned: a) while driving a Government owned vehicle (GOV) or driving a privately owned vehicle (POV) while on official Government business; or b) using any electronic equipment supplied by the Government when driving any vehicle at any time. All Cooperators, their Employees, Volunteers, and Contractors are encouraged to adopt and enforce policies that ban text messaging when driving company owned, leased or rented vehicles, POVs or GOVs when driving while on official Government business or when performing any work for or on behalf of the Government.

BB. PUBLIC NOTICES. It is Forest Service's policy to inform the public as fully as possible of its programs and activities. The County is/are encouraged to give public notice of the receipt of this award/Master Stewardship Agreement and, from time to time, to announce progress and accomplishments. Press releases or other public notices should include a statement substantially as follows:

> "The Regional Office (R1) of the Forest Service, United States Department of Agriculture, supports this agreement."

The County may call on Forest Service's Office of Communication for advice regarding public notices. The County is/are requested to provide copies of notices or announcements to the Forest Service Program Manager and to Forest Service's Office Communications as far in advance of release as possible.

CC. FUNDING EQUIPMENT AND SUPPLIES. Federal funding under this Master Stewardship Agreement are not available for reimbursement of County's purchase of equipment and supplies. Equipment is defined as having a fair market value of over $5,000 per unit and a useful life of over one year.

DD. PROPERTY IMPROVEMENTS. Improvements placed on National Forest System land at the direction or with approval of the Forest Service becomes property of the United States. These improvements are be subject to the same regulations and administration of the Forest Service as would other National Forest improvements of a similar nature. No part of this Master Stewardship Agreement entitles County to any interest in the improvements, other than the right to use and enjoy them under applicable Forest Service regulations.

EE. CONTRACT REQUIREMENTS. Any contract under this agreement must be awarded following County's established procedures, to ensure free and open competition, and avoid any conflict of interest (or appearance of a conflict). County shall maintain cost and price analysis documentation for potential Forest Service review. County is encouraged to utilize small businesses, minority-owned firms and women's business enterprises.

FF. MINIMUM WAGE AND PAID SICK LEAVE REQUIREMENTS. Executive Order 14026, Increasing the Minimum Wage for Federal Contractors, and its implementing regulations, including the federal contractor minimum wage clause at 29 CFR Part 23, Appendix A, and Executive Order 13706, Establishing Paid Sick Leave for Federal Contractors, and its implementing regulations, including the federal contractor paid sick leave clause at 29 CFR Part 13, Appendix A, apply to the Cooperator and any subcontractors under this agreement. These regulatory requirements are incorporated by reference into this agreement as if fully set forth in this agreement.

GG. GOVERNMENT-FURNISHED PROPERTY . The County may only use Forest Service property furnished under this Master Stewardship Agreement for performing tasks assigned in this Master Stewardship Agreement. The County shall not modify, cannibalize, or make alterations to Forest Service property. A separate document, Form AD-107, must be completed to document the loan of Forest Service property. The Forest Service shall retain

title to all Forest Service-furnished property. Title to Forest Service property must not be affected by its incorporation into or attachment to any property not owned by the Forest Service, nor must the property become a fixture or lose its identity as personal property by being attached to any real property.

Partner Liability for Government Property.

1. Unless otherwise provided for in the Master Stewardship Agreement, County shall not be liable for loss, damage, destruction, or theft to the Government property furnished or acquired under this contract, except when any one of the following applies—
   a. The risk is covered by insurance or County is/are otherwise reimbursed (to the extent of such insurance or reimbursement).
   b. The loss, damage, destruction, or theft is the result of willful misconduct or lack of good faith on the part of County's managerial personnel. The County's managerial personnel, in this clause, means County's directors, officers, managers, superintendents, or equivalent representatives who have supervision or direction of all or substantially all of County's business; all or substantially all of County's operation at any one plant or separate location; or a separate and complete major industrial operation.
2. The County shall take all reasonable actions necessary to protect the Government property from further loss, damage, destruction, or theft. The County shall separate the damaged and undamaged Government property, place all the affected Government property in the best possible order, and take such other action as the Property Administrator directs.
3. The County shall do nothing to prejudice the Government's rights to recover against third parties for any loss, damage, destruction, or theft of Government property.
4. Upon the request of the Grants Management Specialist, County shall, at the Government's expense, furnish to the Government all reasonable assistance and cooperation, including the prosecution of suit and the execution of Master Stewardship Agreements of assignment in favor of the Government in obtaining recovery.

HH. OFFSETS, CLAIMS AND RIGHTS. Any and all activities entered into or approved by this Master Stewardship Agreement will create and support afforestation/ reforestation efforts within the National Forest System without generating carbon credits. The Forest Service does not make claims of permanence or any guarantees of carbon sequestration on lands reforested or afforested through County's assistance. The Forest Service will provide for long-term management of reforested and afforested lands, according to applicable Federal statute regulations and forest plans.

II. FOREST SERVICE ACKNOWLEDGED IN PUBLICATION AND AUDIOVISUALS. The County shall acknowledge Forest Service support in any publications, audiovisuals, and electronic media developed as a result of this Master Stewardship Agreement.

JJ. NONDISCRIMINATION STATEMENT – PRINTED, ELECTRONIC, OR AUDIOVISUAL MATERIAL. The County shall include the following statement, in full, in any printed, audiovisual material, or electronic media for public distribution developed or printed with any Federal funding.

"In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)

To file a complaint alleging discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington DC 20250-9410 or call toll free voice (866) 632-9992, TDD (800)877-8339, or voice relay (866) 377-8642. USDA is an equal opportunity provider and employer."

If the material is too small to permit the full statement to be included, the material shall, at minimum, include the following statement, in print size no smaller than the text:

"This institution is an equal opportunity provider."

KK. REMEDIES FOR COMPLIANCE RELATED ISSUES. If County materially fail(s) to comply with any term of the Master Stewardship Agreement, whether stated in a Federal statute or regulation, an assurance, the Master Stewardship Agreement, the Forest Service may take one or more of the following actions:

1. Temporarily withhold cash payments pending correction of the deficiency by County or more severe enforcement action by the Forest Service;

2. Disallow (that is, deny both use of funds and matching credit for) all or part of the cost of the activity or action not in compliance;

3. Wholly or partly suspend or terminate the current Master Stewardship Agreement for County's program;

4. Withhold further awards for the program, or

5. Take other remedies that may be legally available, including debarment procedures under 2 CFR Part 417.

LL. TERMINATION BY MUTUAL AGREEMENT. This Master Stewardship Agreement may be terminated, in whole or part, as follows:

- When the Forest Service and County agree upon the termination conditions, including the effective date and, in the case of partial termination, the portion to be terminated.

- By 30 days written notification by County to the Forest Service setting forth the reasons for termination, effective date, and in the case of partial termination, the portion

to be terminated. If the Forest Service decides that the remaining portion of the Master Stewardship Agreement must not accomplish the purpose for which the Master Stewardship Agreement was made, the Forest Service may terminate the award upon 30 days written notice in its entirety.

Upon termination of an Master Stewardship Agreement, County shall not incur any new obligations for the terminated portion of the Master Stewardship Agreement after the effective date, and shall cancel as many outstanding obligations as possible. The Forest Service shall allow full credit to County for the Forest Service share of obligations that cannot be canceled and were properly incurred by County up to the effective date of the termination. Excess funds shall be refunded within 60 days after the effective date of termination.

MM. ALTERNATE DISPUTE RESOLUTION – PARTNERSHIP AGREEMENT. In the event of any issue of controversy under this Master Stewardship Agreement, the parties may pursue Alternate Dispute Resolution procedures to voluntarily resolve those issues. These procedures may include, but are not limited to conciliation, facilitation, mediation, and fact finding.

NN. DEBARMENT AND SUSPENSION. The County shall immediately inform the Forest Service if they or any of their principals are presently excluded, debarred, or suspended from entering into covered transactions with the Federal government according to the terms of 2 CFR Part 180. Additionally, should County or any of their principals receive a transmittal letter or other official Federal notice of debarment or suspension, then they shall notify the Forest Service without undue delay. This applies whether the exclusion, debarment, or suspension is voluntary or involuntary.

OO. COPYRIGHTING. The County is/are granted sole and exclusive right to copyright any publications developed as a result of this Master Stewardship Agreement. This includes the right to publish and vend throughout the world in any language and in all media and forms, in whole or in part, for the full term of copyright and all renewals thereof in accordance with this Master Stewardship Agreement.

No original text or graphics produced and submitted by the Forest Service must be copyrighted. The Forest Service reserves a royalty-free, nonexclusive, and irrevocable right to reproduce, publish, or otherwise use, and to authorize others to use the work for Federal government purposes. This right must be transferred to any subcontracts.

This provision includes:

1. The copyright in any work developed by County under this Master Stewardship Agreement.
2. Any right of copyright to which County purchase(s) ownership with any Federal contributions.

PP. PUBLICATION SALE. The County may sell any publication developed as a result of this Master Stewardship Agreement. The publication may be sold at fair market value, which is

initially defined in this Master Stewardship Agreement to cover the costs of development, production, marketing, and distribution. After the costs of development and production have been recovered, fair market value is defined in this Master Stewardship Agreement to cover the costs of marketing, printing, and distribution only. Fair market value must exclude any in-kind or Federal government contributions from the total costs of the project.

QQ. When County is seeking bids for product removal and/or stewardship items, both parties agree that the product rates and stewardship item costs used at the approval of the SPA may be based upon tentative value and planned costs. Both parties agree to establish actual rates for both product and stewardship items prior to commencement of operations. The County will notify the Forest Service in writing 60 days in advance to request appraisal prior to seeking formal bids. Both parties agree to modify the SPA with these actual values and costs. Modified product values shall be greater than or equal to the reappraised rates and value.

Post commencement of work, if there is a change from the established stewardship item rates, the SPA will be modified to increase or decrease the amount of services provided by County, accordingly. Post commencement of work product value rate redeterminations are subject to authorizing regulation.

RR. MODIFICATION. Modifications within the scope of this Master Stewardship Agreement must be made by mutual consent of the parties, by the issuance of a written modification signed and dated by all properly authorized, signatory officials, prior to any changes being performed. Requests for modification should be made in writing, at least 30 days prior to implementation of the requested change. The Forest Service is not obligated to fund any changes not properly approved in advance.

SS. COMMENCEMENT/EXPIRATION DATE. This Master Stewardship Agreement is executed as of the date of the last signature and is effective through August 31, 2034 at which time it will expire. The expiration date is the final date for completion of all work activities under this agreement.

TT. AUTHORIZED REPRESENTATIVES. By signature below, each party certifies that the individuals listed in this document as representatives of the individual parties are authorized to act in their respective areas for matters related to this Master Stewardship Agreement. In witness whereof, the parties have executed this Master Stewardship Agreement as of the last date written below.

9/25/24

BRENT TESKE, Lincoln County Commissioner — Date
Lincoln County

10/1/24

JERRY BENNETT, Interim Executive Director — Date
Lincoln County Port Authority

09/27/2024

CHAD W. BENSON, Forest Supervisor — Date
U.S. Forest Service, Kootenai National Forest

The authority and format of this Master Stewardship Agreement have been reviewed and approved for signature.

MEGAN NEMITZ

Digitally signed by MEGAN NEMITZ
Date: 2024.09.16 14:53:32 -06'00'

MEGAN NEMITZ — Date
U.S. Forest Service Grants Management Specialist

Appendix B. Porter Bench Energy, LLC Biomass Feasibility Study, Volume 2

biomass
FEASIBILITY STUDY

volume
2
july 2010

submitted to

Energy Promotion and Development Division
Montana Department of Commerce

submitted by

Porter Bench Energy LLC

introduction

woody biomass fuel assessment technical report

In 2009 the Montana Reinvestment Act (HB 645) was passed by the 61st Montana Legislature. HB 645 implemented the federal American Recovery and Reinvestment Act (ARRA) of 2009 by appropriating funds for the Montana Department of Commerce to fund biomass project feasibility studies and other expenditures related to biomass.

As a result of the HB 645 appropriation, the Department of Commerce provided an opportunity for private companies and other entities to apply for grants to prepare studies to determine the feasibility of building and operating one or more biomass energy generation plants in western Montana. This grant application process was concluded in the fall of 2009 and grants were awarded to four entities.

Porter Bench Energy, LLC (PBE)[1] was selected by the Montana Department of Commerce and was contracted to assess the following key elements of woody biomass energy development:

- Assessment of biomass fuel supply in western Montana,
- Description of a typical biomass plant facility,
- Description of regulatory and permitting considerations,
- Identification of one or more potential plant sites,
- Assessment of financial feasibility, and
- Preparation of a comprehensive document for use by the Montana Department of Commerce in considering woody biomass energy development.

The Biomass Feasibility Study Report is the result of work conducted by the PBE team from Fall 2009 through April 2010.

Volume 1 of the study is published separately. It includes a summary of a comprehensive assessment of the woody biomass fuel supply and its availability in western Montana (Chapter 2). A description of a typical biomass plant (including its inputs, outputs, site requirements, impacts,

1 PBE's technical team consists of Transfield Services North America, Environomics, PB Americas, Inc., ENGlobal Engineering Services, Meteorological Solutions Inc., and Parsons Behle Latimer.

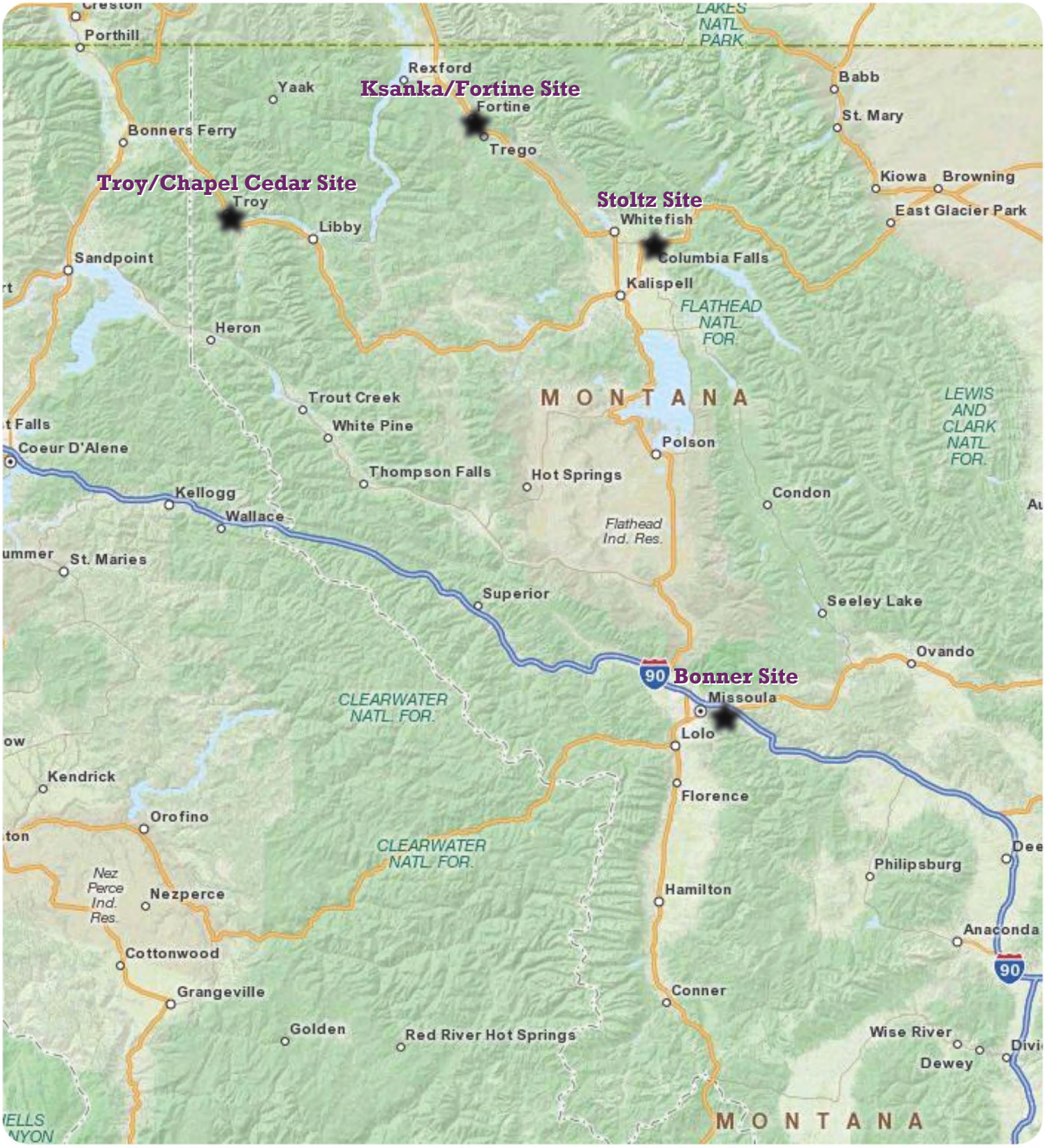
and operating and maintenance characteristics) is contained in Chapter 3. Chapter 4 contains a description and explanation of significant permitting considerations. An assessment of specific sites and a description of feasible sites are provided in Chapter 5. The financial feasibility of developing a biomass plant is discussed in Chapter 6. Chapter 7 provides conclusions and suggestions for additional actions and investigation based on the foregoing analyses.

Volume 2 Woody Biomass Fuel Assessment Technical Report is a supplement to Volume 1. It provides very detailed fuel assessments for four areas in western Montana. These general locations are shown on Figure 1 and include Bonner in the Missoula area; an area around Glacier National Park and Columbia Falls; the Eureka-Fortine area; and the Troy area.

It should be noted that the fuel assessment reflected in both Volumes 1 and 2 of this Feasibility Study uses dry tons while the actual feasibility of a 60 megawatt biomass plant considered in this study uses green tons. This difference is explained by two factors:

- Fuel information is based on available Forest Inventory and Analysis EVALIDator data and information obtained from forest owners. As such, it is typically related to the forestry industry and the finished product output which is generally expressed in dry tons and board feet.
- This feasibility study for a biomass fueled power plant including the equipment selection and financial pro forma is based on the usage of green tons. In a biomass power plant, the wood harvest is utilized immediately and the moisture content only decreases minimally from the time of harvest to the time of processing and burning. As such, the financial inputs for the pro forma were based on the cost of harvesting, delivering and processing green tons at the plant and the equipment selection and associated thermal output was also based on a projected moisture content in the green tons.

The discussion presented in the following chapters focuses primarily on estimates expressed in dry tons.



Porter Bench Energy LLC

Energy Promotion and Development Division
Montana Department of Commerce

figure title

Potentially Feasible Biomass Plant Sites

date

June 2010

figure number 1

chapter A
bonner, montana

The Bonner site is located east of Missoula on Interstate 90, adjacent to the Montana Rail Link's main line. Of the sites considered, this feasibility study concluded that this has the highest current potential for a 60 megawatt biomass plant. There is an abundance of private, state, tribal and federal timberland within 40 and 70 mile radiuses of the site. Until recently, this area had been home to wood product manufacturers for nearly 100 years. There is strong landowner and community interest in developing a facility on this site.

Estimates of the quantity of biomass potentially available from live and standing dead trees and forested and timberland acres were made using the latest (2003 to 2008) Forest Inventory and Analysis (FIA) EVALIDator data. Estimates of logging residue were made using the latest (2004) information in the FIA Timber Products Output (TPO) database. Estimates were done for both a 40-mile radius and a 70-mile radius from the Bonner site. Figure A-1 shows an overview of these radii and land ownership.

The total acreage of forests, by owner, within 40 miles of Bonner is shown in Table A1.

Table A1: Total Forest Acres Within 40-mile Radius of Bonner

Ownership	Forested Acres**	Percent of Total
National Forest System	962,988	43%
Bureau of Land Mgmt	67,651	3%
US Fish & Wildlife	11,339	1%
State	216,276	10%
County & Municipal	7,843	0%
All Private	981,834	44%
Total	2,247,931	100%

** Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment.

The ownership of privately held acreage within a 40-mile radius of Bonner is summarized in Table A2.

Table A2: Privately-owned Timberland Within 40-mile Radius of Bonner*

Ownership	Timber Acres**	Percent of Total Private
Plum Creek/Nature Conservancy	443,868	49%
Stimson Lumber	41,933	5%
Western Pacific Timberlands	21,760	2%
YT Timber	1,073	0%
Other Private	473,200	46%
Total	981,834	100%

* From Montana Cadastral Database
** Timber acres is defined by the Montana Cadastral Database as "acres of the parcel in forestland exceeding 15 contiguous acres that is capable of producing timber that can be harvested in commercial quantity."

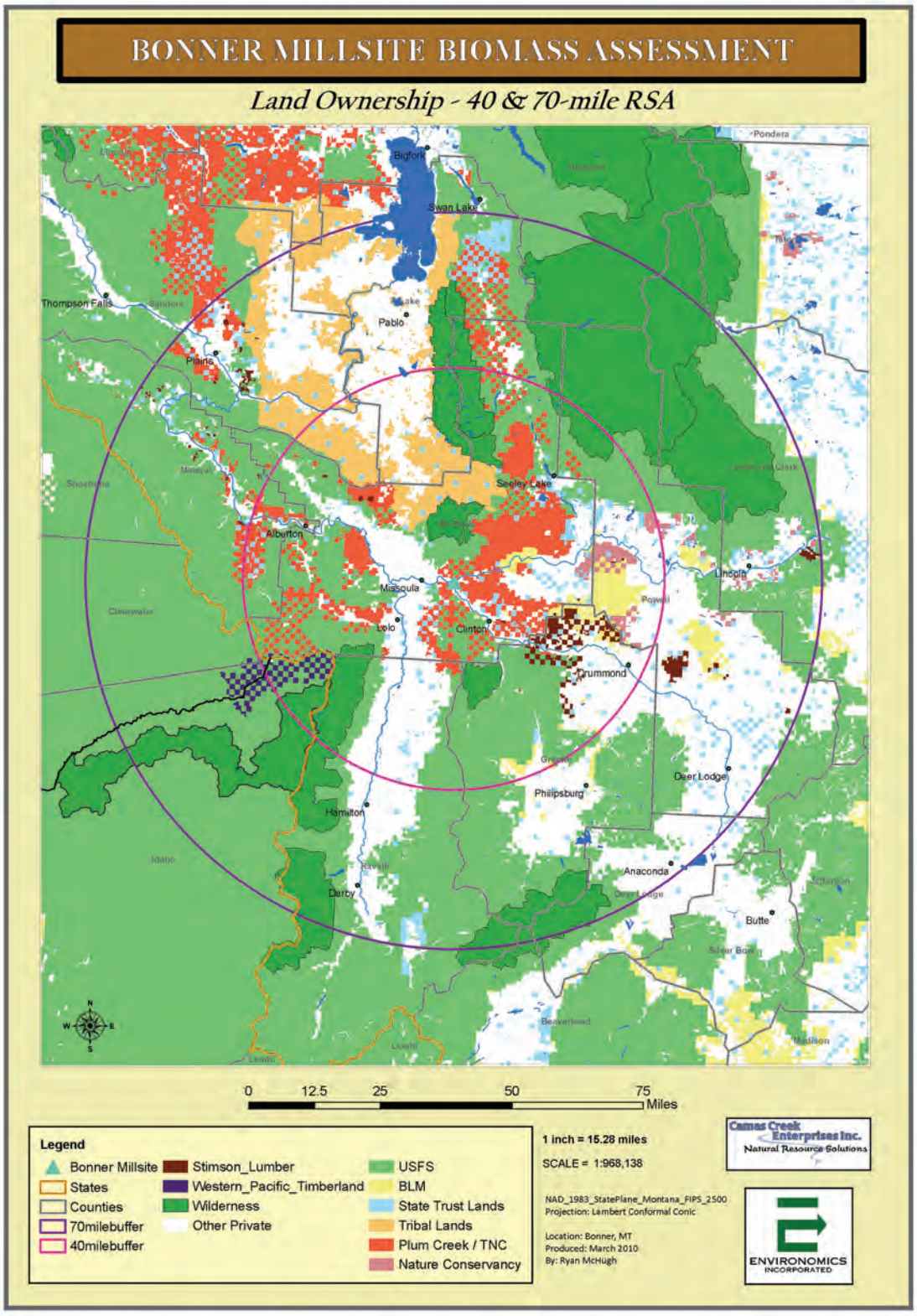

BONNER MILLSITE BIOMASS ASSESSMENT
Land Ownership - 40 & 70-mile RSA
Pondera
Bigfork
Swan Lake
Thompson Falls
Pablo
Plains
Seeley Lake
Alberton
Missoula
Lincoln
Powell
Lolo
Clinton
Drummond
Deer Lodge
Philipsburg
Hamilton
Anaconda
Darby
Butte
Beaverhead
Madison
0 12.5 25 50 75 Miles
Legend
Bonner Millsite
States
Counties
70milebuffer
40milebuffer
Stimson_Lumber
Western_Pacific_Timberland
Wilderness
Other Private
USFS
BLM
State Trust Lands
Tribal Lands
Plum Creek / TNC
Nature Conservancy
1 inch = 15.28 miles
SCALE = 1:968,138
NAD_1983_StatePlane_Montana_FIPS_2500
Projection: Lambert Conformal Conic
Location: Bonner, MT
Produced: March 2010
By: Ryan McHugh
Camas Creek Enterprises Inc.
Natural Resource Solutions
ENVIRONOMICS
INCORPORATED

Figure A-1

The volume of standing biomass on the forested acres within 40 miles of the Bonner site is shown in Table A3.

Table A3*: Dry Tons of Live Tree and Sapling Biomass Within 40-mile Radius of Bonner

Ownership	% of Total	1.0-2.9"	3.0-4.9"	5.0-6.9"	7.0-8.9"	9.0-10.9"	11.0 +"	Total
National Forest System	56%	620,448	1,738,080	3,655,637	5,628,531	5,231,659	21,964,738	38,839,092
Bureau of Land Mgmt	5%	58,782	258,502	589,119	628,784	520,272	1,521,773	3,577,232
State of Montana	11%	59,749	188,176	264,301	559,867	759,891	5,665,641	7,497,627
Private	28%	314,635	846,745	1,513,648	2,757,906	3,036,675	10,550,074	19,019,683
Total	100%	1,053,614	3,031,503	6,022,705	9,575,088	9,548,497	39,702,226	68,933,634

* Data from biomass supply requests, 2010

Not all of the forested acres are available for timber harvest. In an effort to get an idea of what forested lands are realistically available for timber management over time and the current status of standing timber on those lands at this specific time, certain 'screens' were identified that limit the land base considered for analysis. Based on the land ownership, these included:

- On US Forest Service lands, data provided is from those lands that are within the wildland/urban interface (WUI).
- On BLM lands, only those acres outside of Wilderness Study Areas (WSA's) were considered.
- On Bureau of Indian Affairs lands, acres that are not reserved from timber harvest (non-reserved lands) were included.
- On state lands, lands that are not-deferred from timber management (non-deferred) were considered.

Two other additional screens were used: only those forested acres that have ground slopes of less than 40%; and, on US Forest Service forested acres; any lands that have a stand designation of "old-growth" were excluded.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) is included in Tables A4 and A5. The data provided in them is a compilation of information provided by public land managing agencies in response to a collaborated request of biomass analysis from Porter Bench Energy and Northwest Energy using the screens discussed above.

Table A4*: Forested Acres by Ownership

Attribute	USFS	BLM	BIA	DNRC	Private**
Total Forested Acres	580,501	74,748	471,213	96,554	981,834
Screened Acres Analyzed*	103,125	48,453	222,180	75,133	566,223

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

This screening of acreages lowers the quantities of biomass potentially accessible for management within the 40-mile working circle as identified in Table A5.

Table A5*: Biomass on Screened Acres

Attribute	USFS	BLM	BIA	DNRC	Private**
Total Biomass on Screened Acres (Dry Tons)	5,486,252	610,472	6,048,350	1,891,976	12,079,624

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Owners have a variety of management regimes on forested lands with each management regime designed to achieve specific long and short term results. While it is not possible to list all of the management desires of all owners within a working circle, it is possible to identify the annual harvest from the lands within a given radius of a site by using the Forest Inventory Analysis Timber Product Output database (CY 2004). Harvest outputs from year to year reflect the implementation of the individual harvest planning of forest owners in an area. Therefore, it is harvest patterns that serve as the basis for determining available biomass within working specific working circles around each potential power generating site.

Further, harvest processes generate logging residue that can be quantified as available woody biomass. In talking with a number of experts from environmental and economical perspectives, Environomics learned that each thousand board feet harvested generates from 1 to 1.2 dry tons of biomass residue, though only about 40% of the residue is economically accessible for removal and transport (accessibility factor = 40%).

The following harvest volumes and correspondent residue for 2004 by county within 40-mile radius of Bonner were identified and are shown in Tables A6 and A7.

Table A6: Harvest Volumes for 2004 by County Within 40-mile Radius of Bonner

County	Million Board Feet (MMBF)*	Percent of Total	Residues Produced/MBF (Dry Tons)
Missoula	109	34%	1.1
Sanders	75	23%	1.1
Powell	46	14%	1.2
Mineral	41	13%	1.0
Lake	33	10%	1.1
Ravalli	13	4%	1.1
Deer Lodge	4	1%	1.0
Total	321**	100%	1.1

* Volumes are Scribner board feet
** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvests. The volume of trees being cut is likely to be much lower than 2004 levels. 2008 harvest volume in these counties is estimated at 193 MMBF.

Table A7: Estimated Unused 2004 Forest Residues by County Within 40-mile Radius (Dry Tons)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Missoula	14,993	108,681	123,674	34%
Sanders	20,448	65,478	85,926	24%
Powell	7,023	47,243	54,266	15%
Mineral	17,169	24,185	41,354	11%
Lake	5,838	30,975	36,813	10%
Ravalli	6,081	8,677	14,758	4%
Deer Lodge	0	4,047	4,047	1%
Total	71,552	289,286	360,838	100%

* The 2008 timber harvest levels were approximately 60% of the 2004 harvest.

The volume of logging residue currently being produced is likely to be much lower than 2004 levels. Table A8 identifies the probable harvests and probable residue values for those residues that are accessible for 2008.

Table A8: Annual Forest Harvest Residue Available Within 40 Miles of Bonner*

Dry tons/year (2004)	360,838
Harvest reduction from 2004 levels**	0.6
Dry tons/year (2008)	216,503
Accessibility factor	40%
Potentially accessible dry tons/year in the 10 county study area	86,601

* Estimated unutilized residue volumes by counties located wholly or partially within the 40-mile radius of Bonner, Bone Dry Tons
** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest.

MUNICIPAL SOLID WASTE

The local solid waste disposal company (Allied Waste) owns and operates a state licensed waste disposal facility in Missoula, which serves over 500,000 customers in six counties in western Montana (Missoula, Granite, Sanders, Lake, Flathead & Mineral) plus four counties in Idaho (Benewah, Clearwater, Lewis & Shoshone). The Missoula landfill is projected to receive in excess of 200,000 tons of municipal waste material annually. In a study completed by Camas Creek researchers, an Environomic's subcontractor on this report, it is projected that 9% to 17% of the Missoula landfill's 200,000 ton annual waste stream would consist of urban wood waste. Those calculations produce a relatively wide range in variability to demonstrate that the Missoula landfill receives approximately 18,000 to 34,000 tons of urban wood waste per year. Based on previous research estimates of non-suitable urban wood waste, Camas Creek further calculations deducted 40% of those stated amounts and determined that the Missoula landfill's suitable urban wood waste supply was conservatively estimated to be between 10,000 and 20,000 tons annually.

It should be noted that there are two major competitors for unprocessed wood waste in the Missoula area which currently constrain the amount of urban wood waste that might otherwise be delivered to the Allied Waste landfill site. Johnson Brothers Contracting and Eko Compost currently operate collection yards in Missoula that encourage residents and businesses to dispose of their clean tree and wood waste at no charge. There should be an opportunity to increase the collection of urban wood waste at the transfer sites within the Allied service area if separate containers were designated for suitable woody biomass.

UTILITY LINE MAINTENANCE & CONSTRUCTION

Camas Creek, Environomic's subcontractor, interviewed the utility line vegetation manager at North Western Energy, and determined that nearly all of the woody biomass residues created from utility line maintenance are currently unutilized, either deposited at local dump sites or

scattered in the right-of-way. This category of wood waste represents a potentially significant source of woody biomass feedstock for the Bonner site, but no quantities have been calculated.

70-MILE WORKING CIRCLE ANALYSIS

Environomics also analyzed forest biomass available within a 70-mile radius of the Bonner site.

The total acreage of forests, by owner, within 70 miles of Bonner is shown in Table A9.

Table A9: Forested Acres Within a 70-mile Radius of Bonner

Ownership	Acres	Percent of Total
National Forest System*	2,787,028	56%
Bureau of Land Mgmt*	110,262	2%
US Fish & Wildlife	11,339	0%
State	310,821	6%
County & Municipal	7,843	0%
All Private	1,786,314	36%
Total	5,013,607	100%

* Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment and which is not permanently reserved from wood products utilization through statute or administrative designation."

The ownership of privately held acreage within a 70-mile radius of Bonner is summarized in Table A10.

Table A10: Privately Owned Timberland Within a 70-mile Radius of Bonner*

Ownership	Timber Acres**	Percent of Total Private
Plum Creek/Nature Conservancy	555,565	31%
Stimson Lumber	65,380	4%
Western Pacific Timberlands	40,319	2%
YT Timber	12,483	1%
Other Private	1,112,567	62%
Total	1,786,314	100%

* From Montana Cadastral Database
** Timber acres is defined by the Montana Cadastral Database as "acres of the parcel in forest land exceeding 15 contiguous acres that is capable of producing timber that can be harvested in commercial quantity."

Table A11 shows the volume of standing biomass on the forested acres within 70 miles of the Bonner site.

Table A11: Dry Tons of Live Tree and Sapling Biomass Within 70-mile Radius of Bonner*

Ownership All Classes	% of Total	Total	1.0-2.9"*	3.0-4.9"	5.0-6.9"	7.0-8.9"	9.0-10.9"	11.0 +"
NF System	69%	113,737,799	1,613,181	4,445,600	9,280,275	16,189,337	17,191,137	65,018,270
Bureau of Land Mgmt	3%	5,724,708	94,972	401,992	902,372	904,411	734,310	2,686,649
State	6%	10,356,344	114,137	380,803	428,067	889,428	1,150,665	7,393,243
Private	21%	35,364,259	634,556	1,597,208	2,954,162	4,895,500	5,400,766	19,882,068
Total	100%	165,183,110	2,456,846	6,825,603	13,564,876	22,878,676	24,476,878	94,980,230

* Diameter at Breast Height Class (in)

Just as indicated in the 40-mile working circle analysis, not all of the forested acres are available for timber harvest in the 70-mile working circle. The following table US Forest Service lands within the wildland/urban interface (WUI); BLM lands outside of Wilderness Study Areas (WSA's); Bureau of Indian Affairs non-reserved lands; and state lands that are not-deferred from timber management (non-deferred).

Only those forested acres that have ground slopes of less than 40% were included. US Forest Service forested acres that have a stand designation of "old-growth" were excluded.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) is included in Table A12.

Table A12: 70-mile Forested and Screened Acres by Ownership*

Attribute	USFS	BLM	BIA	DNRC	Private**
Total Forested Acres	1,694,344	104,316	471,213	214,941	1,786,314
Screened Acres Analyzed	312,695	72,910	222,180	157,702	1,156,590

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

This screening of acreage also lowers the quantities of biomass potentially accessible for management within the 70-mile working circle as shown in table A13.

Table A13: 70-mile Biomass on Screened Acres*

Attribute	USFS	BLM	BIA	DNRC	Private**
Total Biomass on Screened Acres (Dry Tons)	14,446,501	512,512	7,069,420	3,698,079	24,148,651

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

The harvest volumes and correspondent logging residue values for 2004 by county within 70-mile radius of Bonner are shown in Table A14 and Table A15.

Table A14: Harvest Volumes Within 70-mile Radius of Bonner*

County	Million Board Feet (MMBF)	Percent of Total	Residues Produced/MBF (Dry Tons)
Flathead	156	30%	1.1
Missoula	109	21%	1.1
Sanders	75	14%	1.1
Powell	46	9%	1.2
Mineral	41	8%	1.0
Lake	33	6%	1.1
Granite	25	5%	1.0
Lewis and Clark	21	4%	1.1
Ravalli	13	2%	1.1
Deer Lodge	4	1%	1.0
Total	523**	100%	1.1

* Volumes are Scribner board feet
** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvests.

The volume of trees being cut is likely to be much lower than 2004 levels. 2008 harvest volume in these counties is estimated at 313 MMBF.

Table A15: Estimated Unused 2004 Forest Residues by County Within 70-mile Radius (Dry Tons)*

County	USFS & Other Public Lands	Private	Total	Percent of Total
Flathead	57,663	114,252	171,915	30%
Missoula	14,993	108,681	123,674	21%
Sanders	20,448	65,478	85,926	15%
Powell	7,023	47,243	54,266	9%
Mineral	17,169	24,185	41,354	7%
Lake	5,838	30,975	36,813	6%
Granite	8,059	17,636	25,695	4%
Lewis and Clark	3,895	18,233	22,128	4%
Ravalli	6,081	8,677	14,758	3%
Deer Lodge	0	4,047	4,047	1%
Total	141,169	439,407	580,576	100%

* The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest.

The volume of logging residue currently being produced is likely to be much lower than 2004 levels.

Table A16 identifies the probable harvests and probable residue values for those residues that are accessible for 2008 and reflect a 60% reduction from 2004 harvest levels.

Table A16: Annual Forest Harvest Residue Available Within 70 Miles of Bonner*

Dry tons/year (2004)	580,576
Harvest Reduction from 2004 levels**	0.6
Dry tons/year (2008)	348,000
Accessibility Factor	40%
Potentially accessible dry tons/year in the 10 county study area	139,200

* Estimated unutilized residue volumes by counties located wholly or partially within the 70-mile radius of Bonner, Bone Dry Tons

** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest.

SUSTAINABILITY

In discussing forest removals for biomass utilization, it is important to understand the forest growth and forest mortality occurring each year on forests surrounding the Bonner site. Within the 70-mile working circle of Bonner, forests on all ownerships grow over 2.4 million bone dry tons of biomass (Table A17). It is worthy of note that on national forest lands within the 70-mile working radius, the forest had more mortality than growth. The forest health crisis that is working towards Montana from both the north and the south is already showing an impact in these 2008 figures.

Table A17: Bonner: Forest Growth Within 70 Miles

Owner	Net Growth In Cubic Feet/Year	Mortality In Cubic Feet/Year	Gross Growth In Cubic Feet/Year	Gross Growth In Bone Dry Tons/Year	Mortality In Bone Dry Tons/ Year
National Forest System	-6,131,436	132,500,928	126,369,492	1,516,434	1,590,011
Bureau of Land Mgmt	8,087,970	847,141	8,935,111	107,221	10,166
State	678,795	9,655,810	10,334,605	124,015	115,870
County & Municipal	21,641	0	0	0	0
Private	39,789,761	15,530,500	55,320,261	663,843	186,366
Total	42,446,731	158,534,378	200,981,109	2,411,773	1,902,413

WOOD PRODUCTS INDUSTRY WITHIN THE WORKING CIRCLE

Table A18 is a list of wood manufacturing plants inside the 70 mile RSA's of Bonner. There are several other types of wood product manufacturing operations in MT. This report includes only those that represent potential competition for the feedstock supplies necessary for additional biomass consumption. Larger diameter green and dead, straight checked timber, while more suitable for the higher values of dimension lumber or log home construction, are included in the lists because they represent entities that will likely be involved in the marketing of materials that can be used for fueling biomass heat/power generation.

Table A18: Wood Products Manufacturing Plants in 70-mile RSA: Bonner

Company	Mill type	City	County	Phone
Mountain West Bark Products	bark/mulch	Superior	Mineral	208-227-1750
Alpine Log Homes	house log	Victor	Ravalli	406-642-3451
Anderson Log Builders	house log	Condon	Missoula	406-754-2218
Bachmann Enterprises	house log	Darby	Ravalli	406-821-2015
Bear Creek Timberwrights	house log	Victor	Ravalli	406-642-6003
Black Dog Timber Products	house log	Stevensville	Ravalli	406-369-2575
Blackfoot Valley Log Homes	house log	Ovando	Powell	406-793-5707
Classic Log Homes	house log	Victor	Ravalli	406-240-1392
Custom Log Homes	house log	Stevensville	Ravalli	406-777-5202
East Fork Log Homes	house log	Conner	Ravalli	406-821-4109
Greg Tracy (deadwood mill)	house log	Victor	Ravalli	406-360-5286
Hummel Log Homes	house log	Condon	Missoula	406-754-2889
Lake Mountain Log Homes	house log	Ovando	Powell	406-793-5518
Legacy Log Homes	house log	St. Ignatius	Lake	406-745-2020
Lion Creek Wood Crafts	house log	Condon	Lake	406-754-2905
Logcrafters Log & Timber Homes	house log	St. Ignatius	Lake	406-745-3482
Master Log Homes	house log	Darby	Ravalli	406-821-3756
Montana Handcrafters	house log	Greenough	Missoula	406-677-3679
Montana Timber Structures	house log	Corvallis	Ravalli	406-961-4469
Montana-Idaho Log & Timber	house log	Victor	Ravalli	406-961-3092
Mountain Logs	house log	Victor	Ravalli	406-961-3222
Mountain View Log Homes	house log	Condon	Missoula	406-754-2228
Neville Log Homes	house log	Victor	Ravalli	406-642-3091
Nordique Systems Log Homes	house log	Condon	Missoula	406-754-5647
Northwest House Logs	house log	Stevensville	Ravalli	406-642-3892
Pioneer Log Homes	house log	Victor	Ravalli	406-961-3273
Real Log Homes	house log	Missoula	Missoula	406-721-1600
Rocky Mountain Log Homes	house log	Hamilton	Ravalli	406-375-1814
Small Diameter Logs Company	house log	Hamilton	Ravalli	406-363-3663
St. Regis Custom Log Homes	house log	St. Regis	Mineral	406-649-2269
Tall Timber Log Homes	house log	Clinton	Missoula	406-825-7704
Telemark Log Works	house log	Darby	Ravalli	406-821-4602
The Rustics Of Montana	house log	Condon	Missoula	406-754-2222
Three K Log Homes	house log	Swan Lake	Lake	406-754-2377
Trout Creek Log Homes	house log	Elliston	Powell	406-492-8410
Western Spirit Log Homes	house log	Corvallis	Ravalli	406-961-3299
Artistic Log Creations	log furn	Stevensville	Ravalli	406-369-1283
Bear Creek Log Furniture	log furn	Corvallis	Ravalli	406-642-9001

Company	Mill type	City	County	Phone
Bearly Making It	log furn	Hamilton	Ravalli	406-363-2875
Blue Dog Custom Log Furniture	log furn	Missoula	Missoula	406-728-3776
Coyote Gulch Log Furniture	log furn	Corvallis	Ravalli	406-961-4195
Creekside Log Creation	log furn	Stevensville	Ravalli	406-777-7121
Darby Woodworks	log furn	Darby	Ravalli	406-821-3333
Dry Creek Log Furniture	log furn	Superior	Mineral	406-822-4358
Grizzly Furniture	log furn	St. Ignatius	Lake	406-745-2494
Montana Log Art	log furn	Victor	Ravalli	406-239-6007
Native Timber Log Furniture	log furn	Polson	Lake	406-883-5801
Pine Ridge Log Furniture	log furn	Superior	Mineral	406-822-4901
Provident Moose Log Furnishings	log furn	Corvallis	Ravalli	406-642-3948
Rustic Creations	log furn	Polson	Lake	406-892-3680
Roseberg Forest Products	particle board	Missoula	Missoula	406-728-3910
Johnson Brothers	pellet	Superior	Mineral	406-882-4971
Alpine Products	post/pole	Condon	Missoula	406-754-2725
Big Sky Forest Products	post/pole	St. Regis	Mineral	406-649-2545
Blixt Rail & Post	post/pole	Hot Springs	Sanders	406-849-5809
Boese's Wood Fence Supplies	post/pole	Philipsburg	Granite	406-859-5031
Bouma Post Yard	post/pole	Lincoln	Lewis & Clark	406-362-4222
Clinton Brown	post/pole	Greenough	Missoula	406-244-3303
Flathead Stickers and Dowel	post/pole	Ronan	Lake	406-883-3397
Foothill Post & Lumber	post/pole	St. Ignatius	Lake	406-745-4931
H & H Pole	post/pole	St. Regis	Mineral	406-649-2108
Pfendler Post & Pole	post/pole	Drummond	Granite	406-288-3817
Porterbilt Co.	post/pole	Hamilton	Ravalli	406-363-1456
Round Wood West	post/pole	Seeley Lake	Missoula	406-677-2300
T & C Fencing	post/pole	Ovando	Powell	406-793-5690
Tricon Timber Post & Pole	post/pole	Superior	Mineral	406-649-2485
Turtle Dove Post & Pole	post/pole	Huson	Missoula	406-626-5710
Advantage Milling	sawmill	Clinton	Missoula	406-825-3447
Blackfoot Tiimber Products	sawmill	Lincoln	Lewis &Clark	406-362-4598
Bromley's Wood Products	sawmill	Alberton	Mineral	406-239-3962
Coyote Forest Management	sawmill	Condon	Missoula	406-754-2473
Dupuis Lumber	sawmill	Polson	Lake	406-883-2420
Finlay Lumber	sawmill	Florence	Ravalli	406-273-0080
Foothill Post & Lumber	sawmill	St. Ignatius	Lake	406-745-4931
Gehring Lumber & House Logs	sawmill	Lincoln	Lewis & Clark	406-362-4864
Hunt's Timbers	sawmill	St. Ignatius	Lake	406-745-4375

Company	Mill type	City	County	Phone
Karrow Lumber Co.	sawmill	Stevensville	Ravalli	970-653-4390
L & L Custom Sawing	sawmill	Lincoln	Lewis &Clark	406-362-4601
Natural Legacy Wood	sawmill	Philipsburg	Granite	208-585-6002
Pyramid Mountain Lumber	sawmill	Seeley Lake	Missoula	406-677-2201
Smith Sawmill	sawmill	Deer Lodge	Powell	406-846-2867
Sun Mountain Lumber	sawmill	Deer Lodge	Powell	406-846-1600
Tricon Timber	sawmill	St. Regis	Mineral	406-649-2485
Valley Board & Beam	sawmill	Stevensville	Ravalli	406-642-6234
Willow Creek Sawmill	sawmill	Corvallis	Ravalli	406-961-2495
Woodrum Lumber Company	sawmill	Superior	Mineral	406-822-1870

The woody biomass consumers are shown in Table A19.

Table A19: Woody Biomass Consumers in Bonner 70-mile RSA

Company	Type	City	County	Dry Tons
Roseberg Forest Products	particle board	Missoula	Missoula	600,000
Johnson Brothers	pellet	Superior	Mineral	unknown
Mountain West Bark Products	bark/mulch	Superior	Mineral	unknown
Darby Schools	boiler fuel	Darby	Ravalli	760
Victor Schools	boiler fuel	Victor	Ravalli	500
Phillipsburg Schools	boiler fuel	Phillipsburg	Granite	400

In December of 2009, the Smurfit-Stone Container facility in Frenchtown closed, resulting in the loss of a 1.5 Million Dry Ton outlet for the state's primary wood products industry. The full effect of this closure has yet to be determined, but there is a clear opportunity for another commercial consumer of woody biomass.

SMURFIT-STONE CONTAINER CLOSURE

In Todd Morgan's biomass study of April 29, 2009, his work indicated that "together, the woody biomass users in Montana consume approximately 2.2 to 2.7 MDT (Million Dry Tons) of woody biomass (including mill residue, roundwood pulpwood, industrial fuelwood, and recycled cardboard) each year, with a single facility accounting for more than one-half of total annual biomass consumption." The single facility was Smurfit Stone and their consumption was around 1.5 million dry tons of biomass per year.

Morgan also noted that there was a sizeable deficit of between the amount of woody biomass demanded/consumed each year versus the amount supplied from in-state mill residue. He noted mill residue production in Montana was only 1.5 MDT in 2004 indicating a deficit 0.7 to 1.2 Million Dry Tons between the amount of woody biomass demanded/consumed (2.2 to 2.7 MDT) in Montana versus the amount supplied from in-state mill residue.

Morgan also noted that the deficit was filled "in part by mill residue from out-of-state mills as well by the use of some slash, industrial fuelwood, and roundwood pulpwood harvested in Montana." His figures suggested that competition existed for the woody biomass supply then available in Montana, particularly for "clean" (i.e., free of rocks, sand, dirt, char, needles, and bark) and dry wood chips and other mill residue.

Prior to closure, the Smurfit-Stone Container facility in Frenchtown increased the amount of roundwood pulpwood purchased to help overcome the deficit of locally available clean chips, and the facility was using more slash and small material with bark on for fuelwood. Morgan also noted that only about 4% (9.1MMCF or million cubic feet) of the timber-processing capacity in the state (Montana's saw and veneer mills, post and pole manufacturers, and log home and log furniture industries) could efficiently utilize trees less than 7 in. dbh that the total timber-processing capacity in these Montana wood products sectors declined about 22% (216 MMCF) from 2003 to 2008.

The conclusion of Morgan's report is of critical importance to the Bonner site. The study found that in-state production of woody biomass from primary timber-processing facilities' mill residue had fallen from about 1.5 MDT to 1.0 MDT annually between 2004 and 2008. As well, between 99 and 100% of mill residue in Montana was being used at that time. Using Morgan's numbers, the December 2009 closure of Smurfit-Stone reversed the trend and suddenly made between 0.3 and 0.8 MDT of woody biomass available as a surplus within the state. Importantly, as the utilization was near capacity prior to the plant closing, the price points for competitively shipping fiber to Frenchtown for use at Smurfit Stone should benefit the Bonner site for biomass development.

Even if a reduction of 20 to 30% of Montana processing capacity is assumed between 2008 and 2010, the amount of biomass surplus available upon Smurfit's closure should be up to 500,000 dry tons of available biomass that was price pointed for Frenchtown and conceivably available for contract to a facility at Bonner.

SUMMARY FOR THE BONNER SITE

If available biomass for a power generating facility is limited to unutilized forest residue within a 70-mile range of the Bonner site, (with 40% of this fiber accessible using current technology), there are some 139,000 dry tons identified as unutilized and available for power generation at the Bonner site. In addition, forest growth of some 689,000 dry tons and forest mortality of over 180,000 dry tons is found on private lands within the 70-mile working circle of Bonner.

Finally, over 1.5 million dry tons of fiber that was flowing to the Smurfit Stone facility less than twenty miles from Bonner was made available to the statewide market when Smurfit announced closure. During the last three months a certain amount of this fiber would have successfully been marketed to other buyers. However, with the overall timber and pulp market still soft, there is undoubtedly a portion of the Smurfit-destined fiber that would be available for long-term contracting at a potential Bonner power

and heat generating facility. Quantifying that amount and assigning a price point are beyond the scope of this report.

Even discounting the fiber on federal lands due to access uncertainty, the Bonner area has the potential to fuel a power generating facility with forest based biomass. The price point for this fuel that will result in a feasible economic model for a power plant needs additional investigation to fully assess feasibility.

chapter B

glacier park international airport kalispell, montana

Glacier Park International (GPI) is the designation that was assigned to the wood processing complex that exists within a 10-mile radius of the Flathead Valley's Glacier International Airport. This is the largest wood processing center left in Montana.

Columbia Falls is the industrial hub of Flathead County and is about five miles north of Glacier Park International airport. Seattle-based Plum Creek Timber Company operates a sawmill and a medium density fiberboard [MDF] manufacturing plant in this area. Plum Creek is Montana's largest wood products manufacturer by both employment and production. The company is also Montana's and the nation's largest timberland owner. The company also operates a plywood plant and stud mill at Evergreen, a Kalispell suburb, about 5 miles south of the airport.

Adjacent to Plum Creek's MDF plant, Stoltze Lumber Company operates a mixed species sawmill that cuts lumber in varying dimensions. Stoltze, a family-owned company based in Minnesota, is Montana's oldest continuously operating lumber manufacturer. It has been operating in the Flathead Valley for more than 100 years.

Below are a series of tables detailing biomass considerations within a 40 and 70 mile radius of GPI. Estimates of the quantity potentially available from live and standing dead trees and forested and timberland acres were made using the latest (2003 to 2008) Forest Inventory and Analysis (FIA) EVALIDator data. Estimates of logging residue were made using the latest (2004) information in the FIA Timber Products Output (TPO) database. Figure B-1 shows an overview of these radii and land ownership.

Table B1 shows the total acreage of forests, by owner, within 40 miles of GPI.

Table B1: Total Forest Acres Within 40-mile Radius of GPI

Ownership	Forested Acres	Percent of Total
National Forest System*	765,850	49%
Bureau of Land Mgmt*	14	.1%
State	155,561	10%
All Private	635,760	40.9%
Total	1,557,185	100%

* Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment.

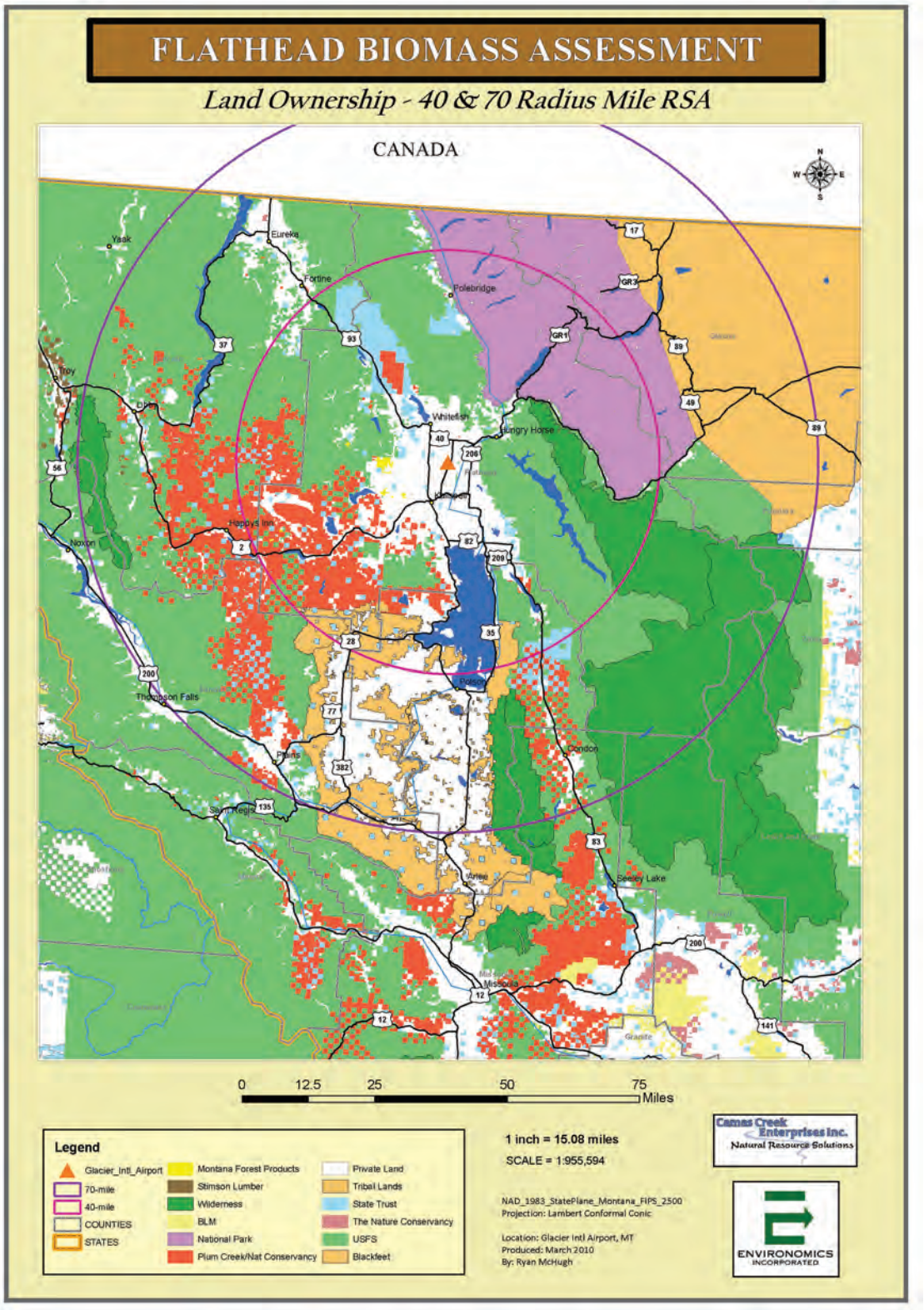

FLATHEAD BIOMASS ASSESSMENT
Land Ownership - 40 & 70 Radius Mile RSA
CANADA
Yaak
Eureka
Fortine
Polebridge
Troy
Libby
Whitefish
Hungry Horse
Happys Inn
Noxon
Thompson Falls
Plains
Condon
Seeley Lake
Missoula
Dixon
0 12.5 25 50 75 Miles
Legend
Glacier_Intl_Airport
70-mile
40-mile
COUNTIES
STATES
Montana Forest Products
Stimson Lumber
Wilderness
BLM
National Park
Plum Creek/Nat Conservancy
Private Land
Tribal Lands
State Trust
The Nature Conservancy
USFS
Blackfeet
1 inch = 15.08 miles
SCALE = 1:955,594
NAD_1983_StatePlane_Montana_FIPS_2500
Projection: Lambert Conformal Conic
Location: Glacier Intl Airport, MT
Produced: March 2010
By: Ryan McHugh
Camas Creek Enterprises Inc.
Natural Resource Solutions
ENVIRONOMICS
INCORPORATED

Figure B-1

Not all of the forested acres are available for timber harvest. In an effort to get an idea of what forested lands are realistically available for timber management over time and the current status of standing timber on those lands at this specific time, certain 'screens' were identified that limit the land base considered for analysis. Based on the land ownership, these included:

- On US Forest Service lands, data provided is from those lands that are within the wildland/urban interface (WUI).
- On BLM lands, only those acres outside of Wilderness Study Areas (WSA's) were considered.
- On Bureau of Indian Affairs lands, acres that are not reserved from timber harvest (non-reserved lands) were included.
- On state lands, lands that are not-deferred from timber management (non-deferred) were considered.

Two other additional screens were used: only those forested acres that have ground slopes of less than 40%; and, on US Forest Service forested acres; any lands that have a stand designation of "old-growth" were excluded.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) is included in the following tables. The data provided in them is a compilation of information provided by public land managing agencies in response to a collaborated request of biomass analysis from Porter Bench Energy and Northwest Energy using the screens discussed above. Table B-2 shows acreage by ownership.

Table B2*: Forested Acres by Ownership

Attribute	USFS	BLM	DNRC	Private**
Total Forested Acres Within Screens	765,850	19	155,561	521,141
Suitable Screened Acres Analyzed	140,284	14	110,198	462,652

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

The quantities of biomass potentially accessible for management within the 40 mile working circle within these screened acres is summarized in Table B3.

Table B3*: Biomass on Screened Acres

Attribute	USFS	BLM	DNRC	Private**
Biomass on Screened Acres (Dry Tons)	6,453,045	2,915,049	0	11,044,541

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Owners have a variety of management regimes on forested lands with each management regime designed to achieve specific long and short term results. While it is not possible to list all of the management desires of all owners within a working circle, it is possible to identify the annual harvest from the lands within a given radius of a site by using the Forest Inventory Analysis Timber Product Output database (CY 2004). Harvest outputs from year to year reflect the implementation of the individual harvest planning of forest owners in an area. Therefore, it is harvest patterns that serve as the basis for determining available biomass within working specific working circles around each potential power generating site.

Further, harvest processes generate logging residue that can be quantified as available woody biomass. In talking with a number of experts from environmental and economical perspectives, it was learned that each thousand board feet harvested generates from 1 to 1.2 dry tons of biomass residue. Only about 40% of the residue, however, is economically accessible for removal and transport (accessibility factor = 40%).

Table B4 shows the resultant harvest residue volumes for 2004 by county within 40-mile radius of GPI.

Table B4: Estimated Unused 2004 Forest Residues in GPI 40-mile Radius (Dry Tons)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Flathead	57,663	114,252	171,915	41%
Lincoln	33,900	90,090	123,990	30%
Sanders	20,448	65,478	85,926	21%
Lake	5,838	30,975	36,813	8%
Total	117,849	204,342	295,295	100%

* The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest. Consequently the volume of logging residue currently being produced is likely to be much lower than 2004 levels.

Table B5 identifies the probable harvests and probable residue values for those residues that are accessible for 2008 and reflect a 60% reduction from 2004 harvest levels.

Table B5: Annual Forest Harvest Residue Available Within 40-miles of GPI*

Dry tons/year (2004)	418,354
Harvest reduction from 2004 levels**	0.6
Dry tons/year (2008)	251,186
Accessibility factor	40%
Potentially accessible dry tons/year in the 10 county study area	100,474

* Estimated unutilized residue volumes by counties located wholly or partially within the 40-mile radius of GPI, Bone Dry Tons.
** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest.

MUNICIPAL SOLID WASTE

Woody biomass from facilities within the working circles of GPI are currently being removed by an area contractor. That contractor stated that the Flathead County disposal site has some 900 dry tons of woody debris available each year, the Eureka facility yields around 500 dry tons, and Happy's Inn yields 150 dry tons. This total of around 1500 tons per year is under contract but is currently not utilized by area biomass consumers.

UTILITY LINE MAINTENANCE & CONSTRUCTION

An interview of the utility line vegetation manager at North Western Energy revealed that nearly all of the woody biomass residues created from utility line maintenance are currently unutilized, either deposited at local dump sites or scattered in the right-of-way. This category of wood waste represents a potentially significant source of woody biomass feedstock for the GPI site, but no quantities have been calculated.

70 MILE WORKING CIRCLE ANALYSIS

Forest biomass available within a 70 mile radius of the GPI site was also evaluated.

Table B6 shows the total acreage of forests, by owner, within 70 miles of GPI.

Table B6: Forested Acres Within a 70-mile Radius of GPI

Ownership	Acres	Percent of Total
National Forest System*	1,842,443	45%
Bureau of Land Mgmt*	202	.01%
BIA, Kootenai Salish	471,213	11%
State	265,353	6.5%
All Private	1,559,057	37%
Total	4,138,268	100%

* Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment and which is not permanently reserved from wood products utilization through statute or administrative designation."

Just as indicated in the 40 mile working circle analysis, not all of the forested acres are available for timber harvest in the 70 mile working circle. The following table lists US Forest Service lands within the wildland/urban interface (WUI); BLM lands outside of Wilderness Study Areas (WSA's); Bureau of Indian Affairs non-reserved lands; and state lands that are not-deferred from timber management (non-deferred).

Only those forested acres that have ground slopes of less than 40% were chosen. No "old-growth" US Forest Service forested acres were considered.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) is included in Table B7 and B8.

Table B7*: Forested and Screened Acres Within 70-mile Radius

Attribute	USFS	DNRC	BLM	BIA	Private**
Total Forested Acres Within Screens	1,843,443	265,353	202	471,213	1,559,057
Screened Acres Analyzed	332,076	192,493	183	222,180	1,320,192

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

This screening of acreage also lowers the quantities of biomass potentially accessible for management within the 70 mile working circle as identified by the Table B8.

Table B8*: Potential Available Biomass Within 70-mile Radius (Dry Tons)

Attribute	USFS	DNRC	BLM	BIA	Private**
Total Biomass On Screened Acres (Dry Tons)	15,308,683	5,307,026	0	7,069,420	23,567,539

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Harvest volumes and correspondent logging residue values for 2004 by county within 70-mile radius of GPI are shown in Table B9.

Table B9: Estimated Unused 2004 Forest Residues by County Within 70-mile Radius (Dry Tons)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Flathead	57,663	114,252	171,915	40%
Lincoln	33,900	90,090	123,990	29%
Sanders	20,448	65,478	85,926	20%
Lake	5,838	30,975	36,813	9%
Glacier	60	10,650	10,710	2%
Total	117,909	311,445	429,354	100%

* The 2008 Montana and Idaho timber harvest levels were approximately 60% of the 2004 harvest. Consequently the volume of logging residue currently being produced is likely to be much lower than 2004 levels.

Table B10 identifies the probable harvests and probable residue values for those residues that are accessible for 2008 and reflect a 60% reduction from 2004 harvest levels.

Table B10: Annual Forest Harvest Residue Available Within 70-miles of GPI*

Dry tons/year (2004)	311,000
Harvest reduction from 2004 levels**	0.6
Dry tons/year (2008)	187,000
Accessibility factor	40%
Potentially accessible dry tons/year in the 10 county study area	74,800

* Estimated unutilized residue volumes by counties located wholly or partially within the 70-mile radius of GPI, Bone Dry Tons.
** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest.

SUSTAINABILITY

In discussing forest removals for biomass utilization, it is important to understand the forest growth and forest mortality occurring each year on forests surrounding the GPI site. Within the 70 mile working circle of GPI, forests on all ownerships grow over 3.0 million bone dry tons of biomass (summarized in Table B11). It is worthy of note that national forest lands within the 70 mile working radius witnessed the heaviest mortality. The forest health crisis that is working towards Montana from both the north and the south is already showing an impact in these 2008 figures.

Table B11: Glacier Park International: Forest Growth Within 70-miles

Owner	Net Growth In Cubic Feet/ Year	Mortality In Cubic Feet/ Year	Gross Growth In Cubic Feet/ Year	Gross Growth In Bone Dry Tons/ Year	Mortality in Bone Dry Tons/ Year
National Forest System	97,664,259	76,809,952	174,474,211	2,093,691	921,719
BIA	9,468,621	188,659	9,657,280	115,892	2,264
State	12,209,820	5,030,091	17,239,911	206,879	60,361
Private	48,915,400	10,798,925	59,714,325	716,572	129,587
Total	168,258,100	92,827,627	261,085,727	3,133,029	1,113,932

WOOD PRODUCTS INDUSTRY WITHIN THE WORKING CIRCLE

Table B12 includes the wood manufacturing plants inside the 70 mile RSA of GPI. There are several other types of wood product manufacturing operations in Montana. For this report, only those that represent potential competition for the feedstock supplies necessary for additional biomass consumption as included. Larger diameter green and dead, straight checked timber, while more suitable for the higher values of dimension lumber or log home construction are included in the lists because they represent entities that will likely be involved in the marketing of materials that can be used for fueling biomass heat/power generation.

Table B12: Wood Products Manufacturing Plants in 70-mile RSA: GPI

Company	Mill type	City	County	Phone
Johnson Brothers	bark products	Olney	Flathead	406-881-3033
Johnson Brothers	bark products	C-Falls	Flathead	406-892-9200
Artisan Log Works	house log	Whitefish	Flathead	406-250-3664
Baldwin Log Homes log home	house log	Kila	Flathead	406-755-7602
Centennial Log Homes	house log	C-Falls	Flathead	406-892-7050
Eureka Montana Log Homes	house log	Eureka	Lincoln	406-889-3293
Homestead Log Works	house log	Rexford	Lincoln	406-889-3052
Kalispell MT Log Homes	house log	Kalispell	Flathead	406-752-2992

Company	Mill type	City	County	Phone
Kootenai Log Homes	house log	Rexford	Lincoln	406-889-5836
Legacy Log Homes	house log	St. Ignatius	Lake	406-745-2020
Meadowlark Log Homes	house log	Libby	Lincoln	406-293-8707
Montana View Log Homes	house log	Rexford	Lincoln	406-889-5472
Old Style Log Works	house log	Kalispell	Flathead	406-755-6669
Shady Grove Log and Timber Builders	house log	Whitefish	Flathead	406-212-0388
Top Notch Log Homes	house log	C-Falls	Flathead	406-892-0596
Agape Log Furniture	log furn	Fortine	Lincoln	406-882-4517
Cabinet Mountain Furniture	log furn	Libby	Lincoln	406-293-5255
Frontier Log Furniture	log furn	Somers	Flathead	406-857-3525
Grizzly Furniture	log furn	Bigfork	Flathead	406-837-3189
Montana Woodworks	log furn	Rexford	Lincoln	406-889-3728
Native Timber Log Furniture	log furn	Polson	Lake	406-883-5801
Rustic Creations	log furn	Polson	Lake	406-892-3680
Rustic Rails Furniture and Log Works	log furn	C-Falls	Flathead	406-892-3680
Simonson's Log Furniture	log furn	Kalispell	Flathead	406-257-6312
Plum Creek	MDF	C-Falls	Flathead	406-892-6486
Johnson Brothers	pellet	Eureka	Lincoln	406- 543-5355
Plum Creek	plywood	C-Falls	Flathead	406-892-6486
Plum Creek	plywood	Kalispell	Flathead	406-892-6486
Blixt Rail and Post	post and pole	Hot Springs	Sanders	406-849-5809
Larry's Post Company	post/pole	C-Falls	Flathead	406-892-5175
Branda Northwest Sawmill	sawmill	Kila	Flathead	406.257.6952
Foothill Post and Lumber	sawmill	St. Ignatius	Lake	406-745-4931
Hunt's Timber's	sawmills	St. Ignatius	Lake	406-745-4375
Jerry Hill	sawmill	West Glacier	Flathead	406-888-5008
Morton Lumber Company	sawmill	Kalispell	Flathead	406-752-0379
Plum Creek	sawmill	Kalispell	Flathead	406-892-6486
Plum Creek	sawmill	C-Falls	Flathead	406-892-6486
RBM Logging and Lumber	sawmill	C-Falls	Flathead	406-892-4208
Shady Grove Log and Timber Builders	sawmill	Whitefish	Flathead	406-212-0388

Table B13 shows the biomass consumers within the 70-mile working circle.

Table B13: Woody Biomass Consumers in Stoltze 70-mile RSA

Company	Type	City	County	Green Tons
Johnson Brothers	bark products	Olney	Flathead	unknown
Johnson Brothers	bark products	C-Falls	Flathead	unknown
Plum Creek	MDF	C-Falls	Flathead	735,000
Johnson Brothers	pellet	Eureka	Lincoln	unknown
Eureka Schools	boiler fuels	Eureka	Lincoln	960

In December of 2009, the Smurfit-Stone Container facility in Frenchtown closed, resulting in the loss of a 1.5 Million Dry Ton outlet for the state's primary wood products industry. The full effect of this closure has yet to be determined, but there is a clear opportunity for another commercial consumer of woody biomass.

The impact of this closure on a potential power generating facility at the GPI site is very hard to quantify. At the time of closure, Smurfit's wood purchasing working circle had expanded to several hundred miles and included the purchase of round logs that they processed into pulp on site. While it is clear that a great deal of woody biomass - including residue from area mills and area contractors - is now without a delivery point, the amount that can be redirected to a power facility and meet the economic needs of both buyer and seller is worthy of study that is beyond the scope of this report.

SUMMARY FOR THE GPI

The public lands portion of existing biomass for the GPI area is huge. The growth of over 3 million bone dry tons per year on just public lands reflects the fact that this is some of the most productive timberlands in the state. However, the huge public lands portion and the uncertainty of supply that goes with that ownership is coupled with the fact that the private portion of this working circle includes the ownership areas of two forest land owners who consume and market nearly all that they grow internally – Plum Creek and Stoltz Land and Lumber. The forest certainly grows enough fiber to fuel a power and heat generating plant in the GPI area. Access to the fiber and securing long term contracts to assure certainty will be needed to make a plant a reality. The best opportunity most likely lies in combining milling and power generating options with one of the two large landowners.

chapter C
eureka/fortine, montana

Fortine is a small sawmill town on Highway 93 midway between Whitefish and Eureka, Montana. Seattle-based Plum Creek Timber Company operated a small log saw mill here for many years, but shut the facility down about a year ago for lack of adequate long-term timber supply.

Owens and Hurst Lumber Company, long-ago owners of the Plum Creek Fortine mill, also operated a small-log sawmill at Eureka for many years, but the company shuttered the mill four years ago because it could no longer find competitively priced logs within a reasonable haul distance of the mill. Previous to Owens and Hurt's closure, another sawmill, American Timber, also closed and liquidated all assets. The equipment from both the Fortine and Eureka mills was sold at auction and nothing remains on either site. Both may have potential for placement of a power plant.

Information was compiled and is summarized for both a 40 and 70 mile radius between the towns of Eureka and Fortine. Figure C-1 shows an overview of these radii and land ownership. This site provides enough fuel supply at any of the other potential sites in the immediate area. Estimates of the quantity potentially available from live and standing dead trees and forested and timberland acres were made using the latest (2003 to 2008) Forest Inventory and Analysis (FIA) EVALIDator data. Estimates of logging residue were made using the latest (2004) information in the FIA Timber Products Output (TPO) database.

The total acreage of forests, by owner, within 40 miles of Eureka/Fortine are shown in Table C1.

Table C1: Total Forest Acres Within 40-mile Radius of Eureka/Fortine

Ownership	Forested Acres*	Percent of Total
National Forest System	1,169,826	78%
Bureau of Land Mgmt	0	0%
State	141,441	10%
All Private	186,474	12%
Total	1,497,741	100%

* Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment.

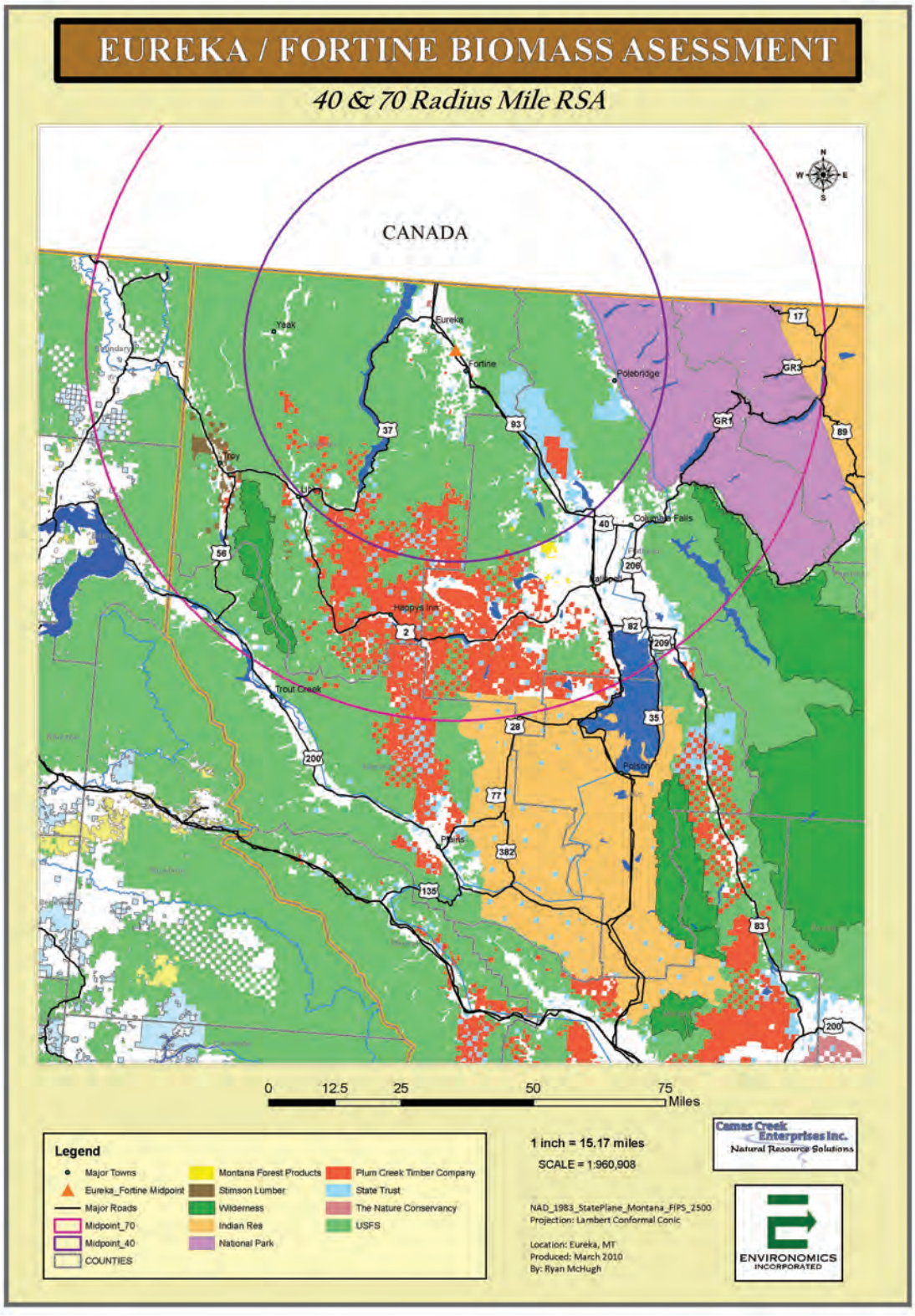

EUREKA / FORTINE BIOMASS ASESSMENT
40 & 70 Radius Mile RSA
CANADA
Yaak
Eureka
Fortine
Polebridge
Troy
Columbia Falls
Happys Inn
Trout Creek
Plains
Paison
0 12.5 25 50 75 Miles
Legend
Major Towns
Eureka_Fortine Midpoint
Major Roads
Midpoint_70
Midpoint_40
COUNTIES
Montana Forest Products
Stimson Lumber
Wilderness
Indian Res
National Park
Plum Creek Timber Company
State Trust
The Nature Conservancy
USFS
1 inch = 15.17 miles
SCALE = 1:960,908
NAD_1983_StatePlane_Montana_FIPS_2500
Projection: Lambert Conformal Conic
Location: Eureka, MT
Produced: March 2010
By: Ryan McHugh
Camas Creek Enterprises Inc.
Natural Resource Solutions
ENVIRONOMICS INCORPORATED

Figure C-1

Not all of the forested acres are available for timber harvest. In an effort to get an idea of what forested lands are realistically available for timber management over time and the current status of standing timber on those lands at this specific time, certain 'screens' were identified that limit the land base considered for analysis. Based on the land ownership, these included:

- On US Forest Service lands, data provided is from those lands that are within the wildland/urban interface (WUI).
- On BLM lands, only those acres outside of Wilderness Study Areas (WSA's) were considered.
- On Bureau of Indian Affairs lands, acres that are not reserved from timber harvest (non-reserved lands) were included.
- On state lands, lands that are not-deferred from timber management (non-deferred) were considered.

Two other additional screens were used: only those forested acres that have ground slopes of less than 40%; and, on US Forest Service forested acres; any lands that have a stand designation of "old-growth" were excluded.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) is included in the following tables. The data provided in them is a compilation of information provided by public land managing agencies in response to a collaborated request of biomass analysis from Porter Bench Energy and Northwest Energy using the screens discussed above. Table C2 shows the acreages by land owner type.

Table C2*: Forested Acres by Ownership

Attribute	USFS	BLM	BIA	DNRC	Private**
Total Forested Acres	1,169,826	0	0	141,441	186,474
Screened Acres Analyzed	196,144	0	0	98,791	142,125

* Data from Biomass Supply Analysis, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

This screening of acreages provides the quantities of biomass potentially accessible for management within the 40-mile working circle as summarized in Table C3.

Table C3*: Biomass on Screened Acres

Attribute	USFS	BLM	BIA	DNRC	Private**
Biomass on Screened Acres (Dry Tons)	10,219,094	0	0	2,861,058	3,747,100

* Data from USFS Biomass Supply Analysis, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Owners have a variety of management regimes on forested lands with each management regime designed to achieve specific long and short term results. While it is not possible to list all of the management desires of all owners within a working circle, it is possible to identify the annual harvest from the lands within a given radius of a site by using the Forest Inventory Analysis Timber Product Output database (CY 2004). Harvest outputs from year to year reflect the implementation of the individual harvest planning of forest owners in an area. Therefore, it is harvest patterns that serve as the basis for determining available biomass within working specific working circles around each potential power generating site.

Further, harvest processes generate logging residue that can be quantified as available woody biomass. In talking with a number of experts from environmental and economical perspectives, it was determined that each thousand board feet harvested generates from 1 to 1.2 dry tons of biomass residue, though only about 40% of the residue is economically accessible for removal and transport (accessibility factor = 40%).

Table C4 reflects this accessibility factor and shows the harvest residue volumes for 2004 by county within 40-mile radius of Eureka/Fortine.

Table C4: Estimated Unused 2004 Forest Residues by County Within 40-mile Radius (Dry Tons*)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Flathead	57,663	114,252	171,915	58%
Lincoln	33,900	90,090	123,990	42%
Total	91,563	204,342	295,295	100%

* The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest. Consequently the volume of logging residue currently being produced is likely to be much lower than 2004 levels.

Table C4.1 translates this into available dry tons of forest residue per year in the two counties, using a 40% accessibility factor.

Table C4.1: Potentially Available Dry Tons Within a 40-mile Radius

Dry tons/year (2004)	295,905
Harvest reduction from 2004	0.6
Dry tons/year (2008)	177,543
Accessibility factor	0.4
Potentially accessible dry tons/year in Eureka/Fortine RSA	84,501

Table C5 summarizes the annual forest harvest residue within the 70-mile working circle.

Table C5: Annual Forest Harvest Residue Available Within 40-miles of Eureka/Fortine*

Dry tons/year (2004)	557,721
Harvest reduction from 2004 levels**	0.6
Dry tons/year (2008)	334,632
Accessibility factor	40%
Potentially accessible dry tons/year in the 10 county study area	159,349

* Estimated unutilized residue volumes by counties located wholly or partially within the 40-mile radius of Eureka/Fortine, Bone Dry Tons.
** The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest.

MUNICIPAL SOLID WASTE

Woody biomass from facilities within the working circles of Eureka/Fortine are currently being removed by an area contractor. That contractor stated that the Eureka disposal site has some 500 dry tons of woody debris available each year, the Flathead facility yields around 900 dry tons, Libby 1000 dry tons and Happy's Inn 150 dry tons. This total of around 2550 tons per year is under contract but is currently not utilized by area biomass consumers.

UTILITY LINE MAINTENANCE & CONSTRUCTION

The utility line vegetation manager at North Western Energy indicated that nearly all of the woody biomass residues created from utility line maintenance are currently unutilized, either deposited at local dump sites or scattered in the right-of-way. This category of wood waste represents a potentially significant source of woody biomass feedstock for the Eureka/Fortine site, but no quantities have been calculated.

70-MILE WORKING CIRCLE ANALYSIS

The total acreage of forests, by owner, within 70 miles of Eureka/Fortine is shown in Table C6.

Table C6: Forested Acres Within a 70-mile Radius of Eureka/Fortine*

Ownership	Acres	Percent of Total
National Forest System*	3,106,306	70%
State (MT)	210,679	5%
State (ID)	25,970	1%
Private (MT)	979,997	22%
Private (ID)	110,701	2%
Total	4,433,653	100%

* Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment and which is not permanently reserved from wood products utilization through statute or administrative designation."

Just as indicated in the 40 mile working circle analysis, not all of the forested acres are available for timber harvest in the 70 mile working circle. Only those forested acres that have ground slopes of less than 40% were included. On US Forest Service forested acres, "old-growth" areas were not included.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) was developed. The data provided in Tables C7, C8 and C9 represent a compilation of information provided by public land managing agencies in response to a collaborated request of biomass analysis from Porter Bench Energy and Northwest Energy using the screens discussed above.

Table C7 shows acreages by land owner.

Table C7*: Forested and Screened Acres Within a 70-mile Radius

Attribute	USFS	DNRC	Private (MT Only)**
Total Forested Acres Within 70 Miles	2,078,510	203,584	979,997
Screened Acres Analyzed	393,175	151,774	835,593
Total Biomass Standing on Screened Acres (dry tons)	22,057,129	4,327,710	14,941,128

* Data from Biomass Supply Analysis, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Table C8 shows harvest volumes and correspondent logging residue values for 2004 by county within 70-mile radius of Eureka/Fortine.

Table C8: Estimated Unused 2004 Forest Residues by County Within 70-mile Radius (Dry Tons*)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Flathead	57,663	114,252	171,915	31%
Bonner/ Boundary**	58,665	106,515	165,180	30%
Lincoln	33,900	90,090	123,990	22%
Sanders	20,448	65,478	85,926	15%
Glacier	60	10,650	10,710	2%
Total	170,736	386,985	557,721	100%

* Data from Timber Product Output (TPO), 2004 (dry tons)
** Idaho county values are CY 2001 (dry tons)

Table C9 identifies the probable harvests and probable residue values for those residues that are accessible for 2008 and reflect a 60% reduction from 2004 harvest levels. The numbers reflect a 40% accessibility factor.

Table C9: Potentially Available Dry Tons Within a 70-mile Radius

Dry tons/year (2004)	557,721
Harvest reduction from 2004	0.6
Dry tons/year (2008)	334,633
Accessibility factor	0.4
Potentially accessible dry tons/year in Eureka/Fortine RSA	133,852

SUSTAINABILITY

In discussing forest removals for biomass utilization, it is important to understand the forest growth and forest mortality occurring each year on forests surrounding the Eureka/Fortine site. Within the 70 mile working circle of Eureka/Fortine, forests on all ownerships grow over 3.0 million bone dry tons of biomass, as shown in Table C10. It is worthy of note that national forest lands within the 70 mile working radius witnessed the heaviest mortality. The forest health crisis that is working towards Montana from both the north and the south is already showing an impact in these 2008 figures.

Table C10: Eureka/Fortine: Forest Growth Within 70-miles

Owner	Montana Net Growth In Cubic Feet/ Year	Montana Mortality In Cubic Feet/ Year	Idaho Net Growth In Cubic Feet/ Year	Idaho Mortality Tons In Cubic Feet/ Year	Gross Growth In Cubic Feet/ Year	Gross Growth In Bone Dry Tons/ Year	Mortality In Bone Dry Tons/ Year
National Forest	128,678,778	60,291,309	12,542,411	11,539,475	213,051,973	2,556,624	861,969
State	11,514,747	2,550,682	311,962	537,499	14,914,890	178,979	37,058
Private	32,413,361	4,512,645	8,486,438	771,573	46,184,017	554,208	63,411
Total	172,606,886	67,354,636	21,340,810	12,848,548	274,150,880	3,289,811	962,438

There are areas of Idaho land that fall within the 70 mile working circle of the Eureka area; however, Eureka is over 100 miles from Idaho and therefore outside the functional economic working circle for power generating biomass. It should also be noted that while there is impressive growth in the forests around the Eureka/Fortine RSA, 78% of that growth is found on national forest lands. The growing stock on private lands is found largely on the single biggest private ownership, Plum Creek.

WOOD PRODUCTS INDUSTRY WITHIN THE WORKING CIRCLE

Table C11 provides a list of wood manufacturing plants inside the 70 mile RSA of Eureka/Fortine. There are several other types of wood product manufacturing operations in Montana. Only those that represent potential competition for the feedstock supplies necessary for additional biomass consumption are included. Larger diameter green and dead, straight checked timber, while more suitable for the higher values of dimension lumber or log home construction are included in the lists because they represent entities that will likely be involved in the marketing of materials that can be used for fueling biomass heat/power generation.

Table C11: Wood Products Manufacturing Plants in 70-mile RSA: Fortine/ Eureka

Company	Mill type	City	County	Phone
Johnson Brothers	bark products	Olney	Flathead	406-881-3033
Johnson Brothers	bark products	C-Falls	Flathead	406-892-9200
Air-Lock Log Homes	house log	T-Falls	Sanders	406-827-3193
Artisan Log Works	house log	Whitefish	Flathead	406-250-3664
Baldwin Log Homes log home	house log	Kila	Flathead	406.755.7602
Blackjack Custom Log Home	house log	T-Falls	Sanders	406-827-3010
Caribou Creek Log Homes, Inc.	house log	Bonners Ferry	Boundary	208-267-7876
Centennial Log Homes	house log	C-Falls	Flathead	406-892-7050
Cougar Ridge Log Homes	house log	Troy	Lincoln	406-295-5434
Diversified House Logs	house log	Troy	Lincoln	406-295-5351
Eureka Montana Log Homes	house log	Eureka	Lincoln	406-889-3293
Homestead Log Works	house log	Rexford	Lincoln	406-889-3052
Kootenai Log Homes	house log	Rexford	Lincoln	406-889-5836
Kalispell MT Log Homes	house log	Kalispell	Flathead	406-752-2992
Meadowlark Log Homes	house log	Libby	Lincoln	406-293-8707
Montana View Log Homes	house log	Rexford	Lincoln	406-889-5472
Old Style Log Works	house log	Kalispell	Flathead	406-755-6669
Shady Grove Log and Timber Builders	house log	Whitefish	Flathead	406-212-0388
Top Notch Log Homes	house log	C-Falls	Flathead	406-892-0596
Agape Log Furniture	log furn	Fortine	Lincoln	406-882-4517
Custom Design Furniture	log furn	Bonners Ferry	Boundary	208-267-5969
Cabinet Mountain Furniture	log furn	Libby	Lincoln	406-293-5255
Frontier Log Furniture	log furn	Somers	Flathead	406-857-3525
Grizzly Furniture	log furn	Bigfork	Flathead	406-837-3189
Montana Woodworks	log furn	Rexford	Lincoln	406-889-3728
Rustic Rails Furniture and Log Works	log furn	C-Falls	Flathead	406-892-3680
Simonson's Log Furniture	log furn	Kalispell	Flathead	406-257-6312
Plum Creek	MDF	C-Falls	Flathead	406-892-6486
Plum Creek	plywood	C-Falls	Flathead	406-892-6486
Plum Creek	plywood	Kalispell	Flathead	406-892-6486
Johnson Brothers	pellet	Eureka	Lincoln	406- 543-5355
North Idaho Energy Logs, Inc.	pellet	Moyie Springs	Boundary	208-267-5311
Larry's Post Company	post/pole	C-Falls	Flathead	406-892-5175
Branda Northwest Sawmill	sawmill	Kila	Flathead	406.257.6952

Company	Mill type	City	County	Phone
Conkle's Custom Cuts	sawmill	Olney	Flathead	406-881-2242
Idaho Forest Group	sawmills	Moyie Springs	Boundary	208-255-3200
Jerry Hill	sawmill	West Glacier	Flathead	406-888-5008
Morton Lumber Company	sawmill	Kalispell	Flathead	406-752-0379
Plum Creek	sawmill	Kalispell	Flathead	406-892-6486
Plum Creek	sawmill	C-Falls	Flathead	406-892-6486
Neumayer Mills Limited	sawmill	Bonners Ferry	Boundary	208-267-2754
RBM Logging and Lumber	sawmill	C-Falls	Flathead	406-892-4208
Russell's Mill	sawmill	Noxon	Sanders	406-847-2075
Shady Grove Log and Timber Builders	sawmill	Whitefish	Flathead	406-212-0388
Specialty Beams	sawmill	Noxon	Sanders	406-847-5510

Table C12 shows the current woody biomass consumers in the 70-mile working circle.

Table C12: Woody Biomass Consumers in Eureka/Fortine 70-mile RSA

Company	Type	City	County	Dry Tons
Eureka Schools	boiler fuels	Eureka	Lincoln	457
Johnson Brothers	bark products	Olney	Flathead	unknown
Johnson Brothers	pellet	Eureka	Lincoln	unknown
Plum Creek	MDF	C-Falls	Flathead	350,000
Troy Schools	boiler fuels	Troy	Lincoln	29

In December of 2009, the Smurfit-Stone Container facility in Frenchtown closed, resulting in the loss of a 1.5 Million Dry Ton outlet for the state's primary wood products industry. The full effect of this closure has yet to be determined, but there is a clear opportunity for another commercial consumer of woody biomass.

The impact of this closure on a potential power generating facility at the Eureka/Fortine site is very hard to quantify. At the time of closure, Smurfit's wood purchasing working circle had expanded to several hundred miles and included the purchase of round logs that they processed into pulp on site. While it is clear that a great deal of woody biomass - including residue from area mills and area contractors - is now without a delivery point, the amount that can be redirected to a power facility and meet the economic needs of both buyer and seller is worthy of study that is beyond the scope of this report.

Finally, the proximity of Eureka-Fortine to the Canadian border raises other issues. While there is a long history of moving fiber across the border, this flow has been inconsistent in volume and pricing. While Provincial management of forest lands includes long term contracts with forest

management companies and those companies have a great deal of flexibility in marketing product, there is also a systemic preference to market fiber to other Canadian interests. Through discussions with associates in British Columbia, it was learned that there may be some potential fiber that would be economically available for the area, but that potential is neither huge nor 100% reliable and quantification of any amounts that may be available is beyond the scope of this report.

SUMMARY FOR THE EUREKA/FORTINE RSA

The public lands portion of existing biomass for the Eureka-Fortine area is significant. Just the mortality on the Forest Service ownership within 70 miles represents over 700,000 tons. The growth of over 2.5 million bone dry tons per year on just public lands reflects the fact that this is some of the most productive timberlands in the state. However, accessibility and uncertainty of supply for biomass on public lands is a major issue and constraint. Biomass on private lands within this working circle includes those lands owned and utilized by Plum Creek and Stoltz Land and Lumber. Although the forest has more than sufficient fiber to fuel a power and heat generating plant in the Eureka-Fortine area, access to the fiber and securing long term contracts to assure certainty will be needed to make a plant a reality.

chapter D
troy, montana

Troy is surrounded by timberland, including some of the most productive forestlands in the entire state. There have been sawmills in Troy from time to time over the last century. It is home to a small cedar manufacturing complex, Chapel Cedar. This firm has expressed interest in siting a biomass power plant; therefore, this site was used as the center of the fiber analysis for the Troy area. The Revett Minerals Troy Mine also has land available for potential industrial use and is 15 miles south of Troy. There is strong local support for such a biomass project in Troy.

Estimates of the quantity potentially available from live and standing dead trees and forested and timberland acres were made using the latest (2003 to 2008) Forest Inventory and Analysis (FIA) EVALIDator data. Estimates of logging residue were made using the latest (2004) information in the FIA Timber Products Output (TPO) database. Information was compiled and is summarized for both a 40 and 70 mile radius from the Troy site. Figure D-1 shows an overview of these radii and land ownership.

The total acreage of forests, by owner, within 40 miles of Troy is shown in Table D1.

Table D1: Total Forest Acres Within 40-mile Radius of Troy

Ownership	Forested Acres	Percent of Total
National Forest System*	1,390,821	72%
State of Montana	26,432	1%
State of Idaho	87,002	4%
All Private (MT and ID)	440,305	23%
Total	1,944,560	100%

* Forested acres on USFS include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment.

Not all of the forested acres are available for timber harvest. In an effort to get an idea of what forested lands are realistically available for timber management over time and the current status of standing timber on those lands at this specific time, certain 'screens' were identified that limit the land base considered for analysis. Based on the land ownership, these included:

- On US Forest Service lands, data provided is from those lands that are within the wildland/urban interface (WUI).
- On BLM lands, only those acres outside of Wilderness Study Areas (WSA's) were considered.
- On Bureau of Indian Affairs lands, acres that are not reserved from timber harvest (non-reserved lands) were included.
- On state lands, lands that are not-deferred from timber management (non-deferred) were considered.

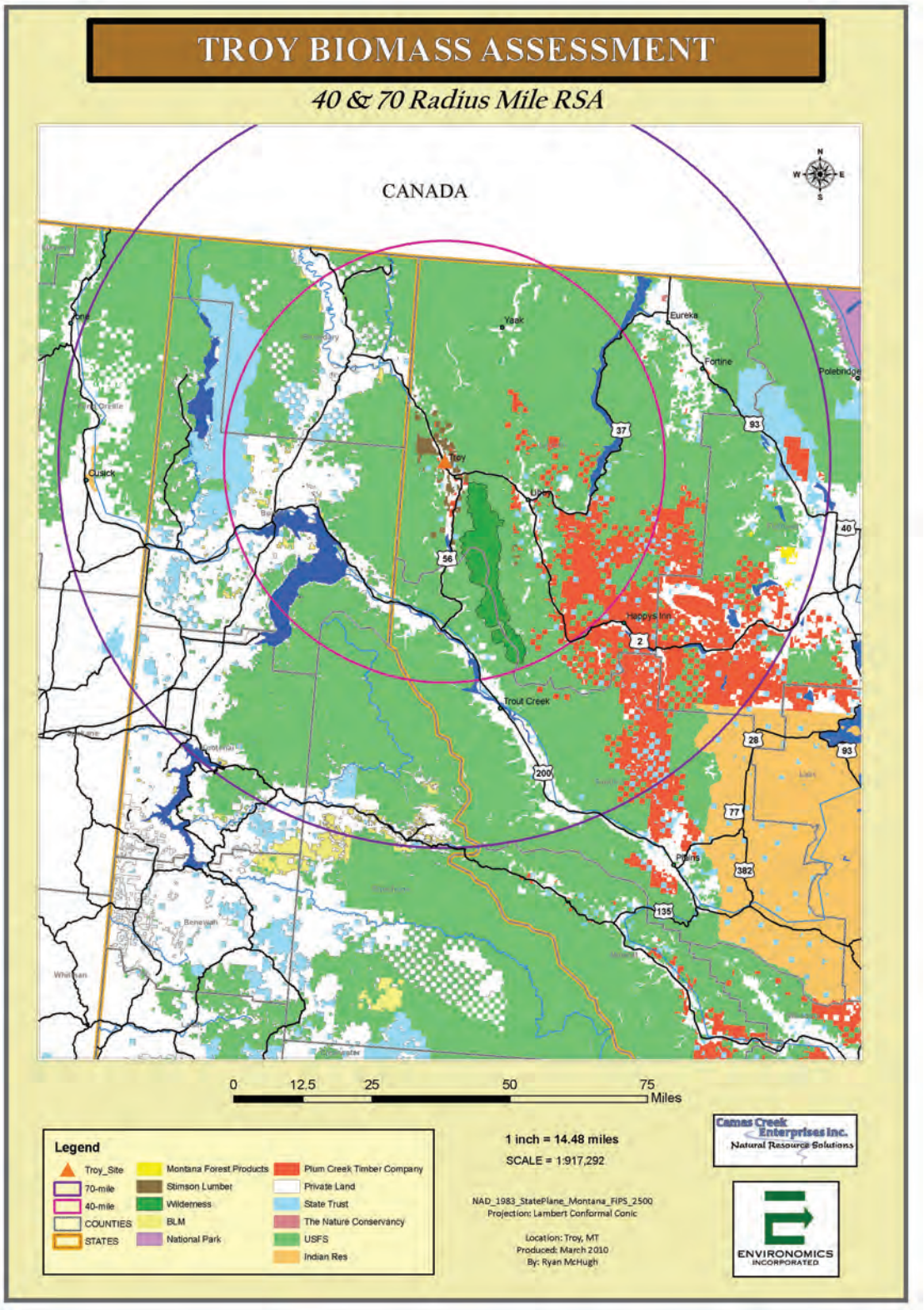

TROY BIOMASS ASSESSMENT
40 & 70 Radius Mile RSA
CANADA
N
W
E
S
Yaak
Eureka
Fortine
Polebridge
Troy
Libby
Cusick
Happys Inn
Trout Creek
Plains
Bonners Ferry
Sandpoint
Whitefish
Kalispell
Columbia Falls
Libby
37
93
56
2
40
28
200
77
382
135
0
12.5
25
50
75
Miles
Legend
Troy_Site
70-mile
40-mile
COUNTIES
STATES
Montana Forest Products
Stimson Lumber
Wilderness
BLM
National Park
Plum Creek Timber Company
Private Land
State Trust
The Nature Conservancy
USFS
Indian Res
1 inch = 14.48 miles
SCALE = 1:917,292
NAD_1983_StatePlane_Montana_FIPS_2500
Projection: Lambert Conformal Conic
Location: Troy, MT
Produced: March 2010
By: Ryan McHugh
Camas Creek Enterprises Inc.
Natural Resource Solutions
ENVIRONOMICS
INCORPORATED

Figure D-1

Two other additional screens were used: only those forested acres that have ground slopes of less than 40% and on US Forest Service forested acres were chosen; any lands that have a stand designation of "old-growth" were excluded.

Information that includes the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead) is included in the following tables. The data provided in them is a compilation of information provided by public land managing agencies in response to a collaborated request of biomass analysis from Porter Bench Energy and Northwest Energy using the screens discussed above.

Table D2 shows the number of forested acres by land ownership category.

Table D2*: Forested Acres by Ownership

Attribute	USFS	DNRC	State of ID	Private**
Total Forested Acres Within Screens	1,390,821	26,432	26,432	440,305
Suitable Screened Acres Analyzed	243,020	21,003	21,003	341,320

* Data from biomass supply requests, 2010
** Private land screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

This screening of acreages provides the quantities of biomass potentially accessible for management within the 40 mile working circle as summarized in Table D3.

Table D3*: Biomass on Screened Acres

Attribute	USFS	MT DNRC	State of ID**	MT Private**	ID Private**
Biomass on Screened Acres (Dry Tons)	15,553,295	851,396	2,874,058	2,087,106	6,520,031

* Data from biomass supply requests, 2010
** Private and Idaho state lands screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Owners have a variety of management regimes on forested lands with each management regime designed to achieve specific long and short term results. While it is not possible to list all of the management desires of all owners within a working circle, it is possible to identify the annual harvest from the lands within a given radius of a site by using the Forest Inventory Analysis Timber Product Output database (CY 2004). Harvest outputs from year to year reflect the implementation of the individual harvest planning of forest owners in an area. Therefore, it is harvest patterns that serve as the basis for determining available biomass within working specific working circles around each potential power generating site.

Further, harvest processes generate logging residue that can be quantified as available woody biomass. In talking with a number of experts from

environmental and economical perspectives, Environomics learned that each thousand board feet harvested generates from 1 to 1.2 dry tons of biomass residue, though only about 40% of the residue is economically accessible for removal and transport (accessibility factor = 40%).

Table D4 shows the harvest residue volumes for 2004 by county within 40-mile radius of Troy.

Table D4: Estimated Unused 2004 Forest Residues by County Within a 40-mile Radius (Dry Tons)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Bonner/ Boundary**	58,665	106,515	165,180	31%
Shoshone**	39,090	110,475	149,565	29%
Lincoln	33,900	90,090	123,990	24%
Sanders	20,448	65,478	85,926	16%
Total	152,103	372,558	524,661	100%

* The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest. Consequently, the volume of logging residue currently being produced is likely to be much lower than 2004 levels. While Idaho public land harvest levels were lower in 2001 than in 2004, we presume that private land harvests were equal to or greater than 2004 values.
** Idaho Counties

The following table identifies the probable harvests and probable residue values for those residues that are accessible for 2008 and reflect a 60% reduction from 2004 harvest levels. The numbers assume a 40% accessibility factor.

Table D5: Annual Potentially Available Dry Tons of Forest Residue Within a 40-mile Radius of Troy

Dry tons/year	524,661
Harvest reduction	0.6
Dry tons/year	314,796
Accessibility factor	40%
Potentially accessible dry tons/year in Troy RSA	125,918

MUNICIPAL SOLID WASTE

Woody biomass from facilities within the working circles of Troy are currently being removed by an area contractor. The Troy disposal site has some 400 dry tons of woody debris available each year; the Libby Dump facility yields around 1000 dry tons; and Happy's Inn yields about 150 dry tons. This total of around 1550 tons per year is under contract but is currently not utilized by area biomass consumers.

UTILITY LINE MAINTENANCE & CONSTRUCTION

The utility line vegetation manager at North Western Energy provided information that nearly all of the woody biomass residues created from utility line maintenance are currently unutilized, either deposited at local dump sites or scattered in the right-of-way. This category of wood waste represents a potentially significant source of woody biomass feedstock for the Troy site, but no quantities have been calculated.

70 MILE WORKING CIRCLE ANALYSIS

Forest biomass available within a 70 mile radius of the Troy site was analyzed.

Table D6 shows the total acreage of forests, by owner, within 70 miles of Troy.

Table D6: Forested Acres Within a 70-mile Radius of Troy

Ownership	Acres	Percent of Total
National Forest System*	2,980,427	61%
State of Montana	180,209	4%
State of Idaho	252,363	5%
All Private (MT and ID)	1,490,096	30%
Total	4,903,095	100%

* Forested acres on USFS and BLM include only non-reserved timberland. Non-reserved Timberlands are defined as: "forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment and which is not permanently reserved from wood products utilization through statute or administrative designation."

Just as indicated in the 40 mile working circle analysis, not all of the forested acres are available for timber harvest in the 70 mile working circle. Available biomass is considered only for only the following lands: US Forest Service lands within the wildland/urban interface (WUI); BLM lands outside of Wilderness Study Areas (WSA's); Bureau of Indian Affairs non-reserved lands; and state lands that are not-deferred from timber management (non-deferred).

Only those forested acres that have ground slopes of less than 40% were chosen. No "old-growth" areas on US Forest Service forested acres were considered.

Table D7 shows the total acres on each of these classifications as well as the forest biomass currently standing on these acres (both live and dead).

Table D7*: Forested and Screened Acres Within a 70-mile Radius of Troy

Attribute	USFS	DNRC	State of ID**	MT Private**	ID Private**
Total Forested Acres	2,980,427	180,209	278,333	896,617	593,479
Screened Acres Analyzed	500,347	135907	181,880	745,760	444,965

* Data from biomass supply requests, 2010
** Private and Idaho state lands screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

This screening of acreage also lowers the quantities of biomass potentially accessible for management within the 70 mile working circle; the results are shown in Table D8.

Table D8*: Potential Available Biomass on Screened Acres Within a 70-mile Radius

Attribute	USFS	DNRC	State of ID**	MT Private**	ID Private**
Biomass On Screened Acres (Dry Tons)	29,170,228	4,192,452	6,615,685	13,065,615	10,306,720

* Data from biomass supply requests, 2010
** Private and Idaho state lands screened for slope only. From Forest Inventory Analysis Evalidator 4.01, Montana 2008

Table D9 shows the harvest volumes and correspondent logging residue values for 2004 by county within 70-mile radius of Troy.

Table D9: Estimated Unused 2004 Forest Residues by County Within a 70-mile Radius (Dry Tons)

County	USFS & Other Public Lands	Private	Total	Percent of Total
Flathead	57,663	114,252	171,915	22%
Bonner/ Boundary**	58,665	106,515	165,180	22%
Shoshone**	39,090	110,475	149,565	19%
Lincoln	33,900	90,090	123,990	16%
Sanders	20,448	65,478	85,926	11%
Kootenai**	1,155	72,375	73,530	10%
Total	210,921	559,185	770,106	100%

* The 2008 Montana timber harvest levels were approximately 60% of the 2004 harvest. Consequently, the volume of logging residue currently being produced is likely to be much lower than 2004 levels. While Idaho public land harvest levels were lower in 2001 than in 2004, we presume that private land harvests were equal to or greater than 2004 values.
**Idaho Counties

Table D10 identifies the probable harvests and probable residue values for those residues that are accessible for 2008 and reflect a 60% reduction from 2004 harvest levels. The numbers assume a 40% accessibility factor.

Table D10: Potentially Available Dry Tons of Forest Residue Within a 70-mile Radius of Troy

Dry tons/year (2004)	770,106
Harvest reduction from 2004	0.6
Dry tons/year (2008)	462,063
Accessibility factor	40%
Potentially accessible dry tons/year in Troy RSL	184,825

SUSTAINABILITY

In discussing forest removals for biomass utilization, it is important to understand the forest growth and forest mortality occurring each year on forests surrounding the Troy site. Within the 70 mile working circle of Troy, forests on all ownerships grow over 3.0 million bone dry tons of biomass, as shown in Table D11. It is worthy of note that national forest lands within the 70 mile working radius witnessed the heaviest mortality. The forest health crisis that is working towards Montana from both the north and the south is already showing an impact in these 2008 figures.

Table D11: Forest Growth Within a 70-mile Radius of Troy

Owner	Montana Net Growth In Cubic Feet/ Year	Montana Mortality In Cubic Feet/ Year	Idaho Net Growth In Cubic Feet/ Year	Idaho Mortality Tons In Cubic Feet/ Year	Gross Growth In Cubic Feet/ Year	Gross Growth In Bone Dry Tons/ Year	Mortality In Bone Dry Tons/ Year
National Forest	142,901,151	50,597,493	72,489,678,	55,093,961	321,082,283	3,852,987	1,268,297
Bureau of Land Mgmt	N/A	N/A	3,793,901	891,495	4,685,396	56,225	10,698
State	4,793,339	4,513,032	11,527,750	6,613,724	27,447,845	329,374	133,521
Private	33,407,632	4,344,884	40,638,820	4,400,639	82,791,975	993,504	104,946
Total	181,102,122	59,455,409	128,450,148	66,999,819	436,007,498	5,232,090	1,517,463

Below is a list of wood manufacturing plants inside the 70 mile RSA of Troy. There are several other types of wood product manufacturing operations in MT. For this report we included only those that represent potential competition for the feedstock supplies necessary for additional biomass consumption. Larger diameter green and dead, straight checked timber, while more suitable for the higher values of dimension lumber or log home construction are included in the lists because they represent entities that will likely be involved in the marketing of materials that can be used for fueling biomass heat/power generation.

Table D12: Wood Products Manufacturing Plants in 70-mile RSA: Troy

Company	Mill type	City	County	Phone
Johnson Brothers	bark products	Olney	Flathead	406-881-3033
Air-Lock Log Homes	house log	T-Falls	Sanders	406-827-3193
Artisan log Works	house log	Whitefish	Flathead	406-250-3664
Baldwin Log Homes log home	house log	Kila	Flathead	406-755-7602
Blackjack Custom Log Home	house log	T-Falls	Sanders	406-827-3010
Caribou Creek Log Homes, Inc.	house log	Bonners Ferry	Boundary	208-267-7876
Clearwater Log Homes	house log	Hayden	Kootenai	208-772-7891
Cougar Ridge Log Homes	house log	Troy	Lincoln	406-295-5434
Diversified House Logs	house log	Troy	Lincoln	406-295-5351
Eureka Montana Log Homes	house log	Eureka	Lincoln	406-889-3293
Homestead Log Works	house log	Rexford	Lincoln	406-889-3052
Kootenai Log Homes	house log	Rexford	Lincoln	406-889-5836
Lammers Unlimited	house log	Coolin	Bonner	208-443-2533
Meadowlark Log Homes	house log	Libby	Lincoln	406-293-8707
Montana View Log Homes	house log	Rexford	Lincoln	406-889-5472
Northern Log Homes, Inc.	house log	Sandpoint	Bonner	208-263-3250
Agape Log Furniture	log furn	Fortine	Lincoln	406-882-4517
Blue Pine Enterprises	log furn	Sandpoint	Bonner	208-263-4074
Cabinet Mountain Furniture	log furn	Libby	Lincoln	406-293-5255
Custom Design Furniture	log furn	Bonners Ferry	Boundary	208-267-5969
Montana Woodworks	log furn	Rexford	Lincoln	406-889-3728
Northwest Handmade Furniture	log furn	Sandpoint	Bonner	208-365-5807
Johnson Brothers	pellet	Eureka	Lincoln	406- 543-5355
Lignetics, Inc.	pellet	Sandpoint	Bonner	208-263-0564
North Idaho Energy Logs, Inc.	pellet	Moyie Springs	Boundary	208-267-5311
L.D. McFarland Company Limited	post/pole	Sandpoint	Bonner	208-263-2141
Mesenbrink Lumber, LLC	post/pole	Hayden	Kootenai	208-772-7259
North Idaho Post and Pole	post/pole	Hayden	Kootenai	208-772-3942
Panhandle Forest Products	post/pole	Cocolalla	Bonner	208-265-4603
North Idaho Wood Preserving	post/pole	Rathdrum	Kootenai	208-687-2702
Ponderay Newsprint Co.	pulp	Usk	Pend Oreille	509-445-1511
Branda Northwest sawmill	sawmill	Kila	Flathead	406-257-6952
Idaho Forest Group	sawmills	Moyie Springs	Boundary	208-255-3200
Merritt Brothers Lumber Company	sawmill	Athol	Kootenai	208-683-3321

Company	Mill type	City	County	Phone
Neumayer Mills Limited	sawmill	Bonners Ferry	Boundary	208-267-2754
Priest Lake Lumber Company, Inc.	sawmill	Priest River	Bonner	208-443-2212
Stimson Lumber Company	sawmill	Priest River	Bonner	208-448-1141
Whiteman Lumber Company, Inc.	sawmill	Cataldo	Shoshone	208-682-4602
Conkle's Custom Cuts	sawmill	Olney	Flathead	406-881-2242
Dickson Woodworks	sawmill	T-Falls	Sanders	406-827-6455
Russell's Mill	sawmill	Noxon	Sanders	406-847-2075
Shady Grove Log and Timber Builders	sawmill	Whitefish	Flathead	406-212-0388
Specialty Beams	sawmill	Noxon	Sanders	406-847-5510

It should be noted that in December of 2009, the Smurfit-Stone Container facility in Frenchtown closed and with it a 1.5 Million Dry Ton outlet for the state's primary wood products industry. The full effect of this closure has yet to be determined, but there is a clear need (most would say an urgency of need) for another commercial consumer of woody biomass.

The impact of this closure on a potential power generating facility at the Troy site is very hard to quantify. At the time of closure, Smurfit's wood purchasing working circle had expanded to several hundred miles and included the purchase of round logs that they processed into pulp on site. While it is clear that a great deal of woody biomass - including residue from area mills and area contractors - is now without a delivery point, the amount that can be redirected to a power facility and meet the economic needs of both buyer and seller is worthy of study that is beyond the scope of this report.

Table D13: Woody Biomass Consumers in Troy 70-mile RSA

Company	Type	City	County	Green Tons
Eureka Schools	boiler fuels	Eureka	Lincoln	960
Johnson Brothers	pellet	Eureka	Lincoln	unknown
Lignetics, Inc.	pellet	Sandpoint	Bonner	163,800
North Idaho Energy Logs, Inc.	pellet	Moyie Springs	Boundary	unknown
Troy Schools	boiler fuels	Troy	Lincoln	60
Johnson Brothers	bark products	Olney	Flathead	unknown
Ponderay Newsprint CO	pulp	Usk	Pend Oreille	350,000

In December of 2009, the Smurfit-Stone Container facility in Frenchtown closed, resulting in the loss of a 1.5 Million Dry Ton outlet for the state's primary wood products industry. The full effect of this closure has yet to be determined, but there is a clear opportunity for another commercial consumer of woody biomass.

The impact of this closure on a potential power generating facility at the Troy site is very hard to quantify. At the time of closure, Smurfit's wood purchasing working circle had expanded to several hundred miles and included the purchase of round logs that they processed into pulp on site. While it is clear that a great deal of woody biomass - including residue from area mills and area contractors - is now without a delivery point, the amount that can be redirected to a power facility and meet the economic needs of both buyer and seller is worthy of study that is beyond the scope of this report.

SUMMARY FOR THE TROY SITE

Forest residue figures for Montana counties partially or wholly included in the Troy RSA's are based upon CY 2004 data from the FIA Timber Product Output (TPO). Idaho figures are also from the TPO, but are based upon CY 2001. Shoshone County was included in the 40 mile RSA because it was partially within it, and that it significantly impacted the total of dry tonnage that could potentially be available. Forest residues from Shoshone and Kootenai Counties within the 70 mile RSA of Troy, while significant, represent very long transportation distances that will preclude much of the available dry tons from being available.

There is significant biomass available in the Troy area; however, the vast majority of it is on federal lands. The City of Troy recently had an in depth biomass study completed that determined that without certainty of access to federal forests, there may be logging and milling residuals sufficient to fuel an 8 to 10 megawatt plant in Troy. Until the access issue over federal lands is corrected, the certainty of supply may preclude a biomass power and heat generating investor from attempting placement in Troy.

Appendix C. Lincoln Electric Co-op Transmission and Distribution Study

Lincoln County Biomass Project Study

LEC Interconnection Analysis and Costs

Prepared by:

Lincoln Electric Cooperative, Inc.

Issue Date: July 30, 2026

Table of contents

1. Purpose

Lincoln Electric Cooperative (LEC) has prepared the following feasibility study for Lincoln County, Montana, installing and operating a biomass power plant (BPP) interconnected to LEC's electrical distribution system.

2. Introduction

LEC is a member-owned rural electric cooperative with its headquarters located in Eureka, Montana. LEC owns and maintains substations, transmission, and electric distribution facilities serving nearly 7,000 meters in portions of Lincoln and Flathead counties in northwest Montana (Figure 1).

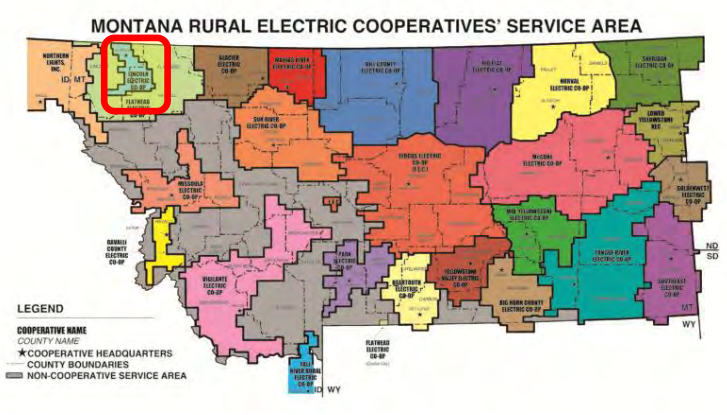


Figure 1 - LEC Service Territory

Lincoln Electric is an all-requirements customer of the Bonneville Power Administration (BPA) and a member of the Pacific Northwest Generating Cooperative (PNGC).

3. Background

LEC is radially fed from one BPA 115 kV transmission line, and owns and operates four substations (Figure 3, next page). The Trego Substation and the Stillwater Substation take delivery from the BPA 115 kV transmission line. The Eureka Substation is fed from LEC's 115 kV transmission line that continues from the Trego Substation. The Tunnel Substation takes delivery at the HT distribution feeder at 14.4/24.9 kV, approximately 13 miles from the Trego Substation (Figure 2, right).

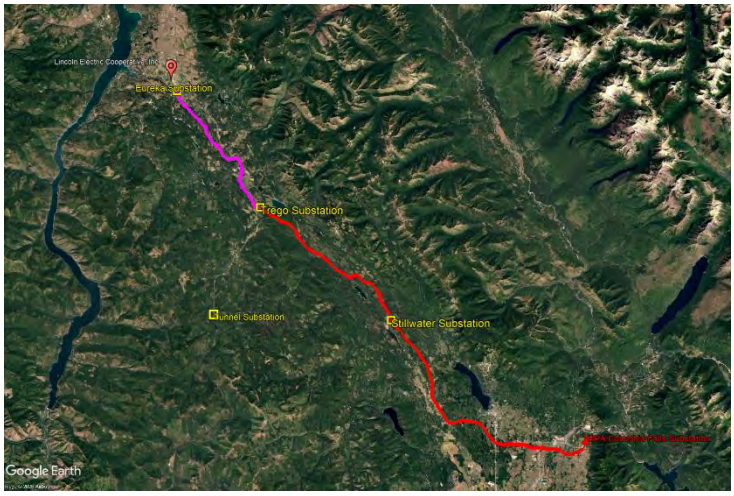


Figure 2 - BPA and LEC Transmission Lines

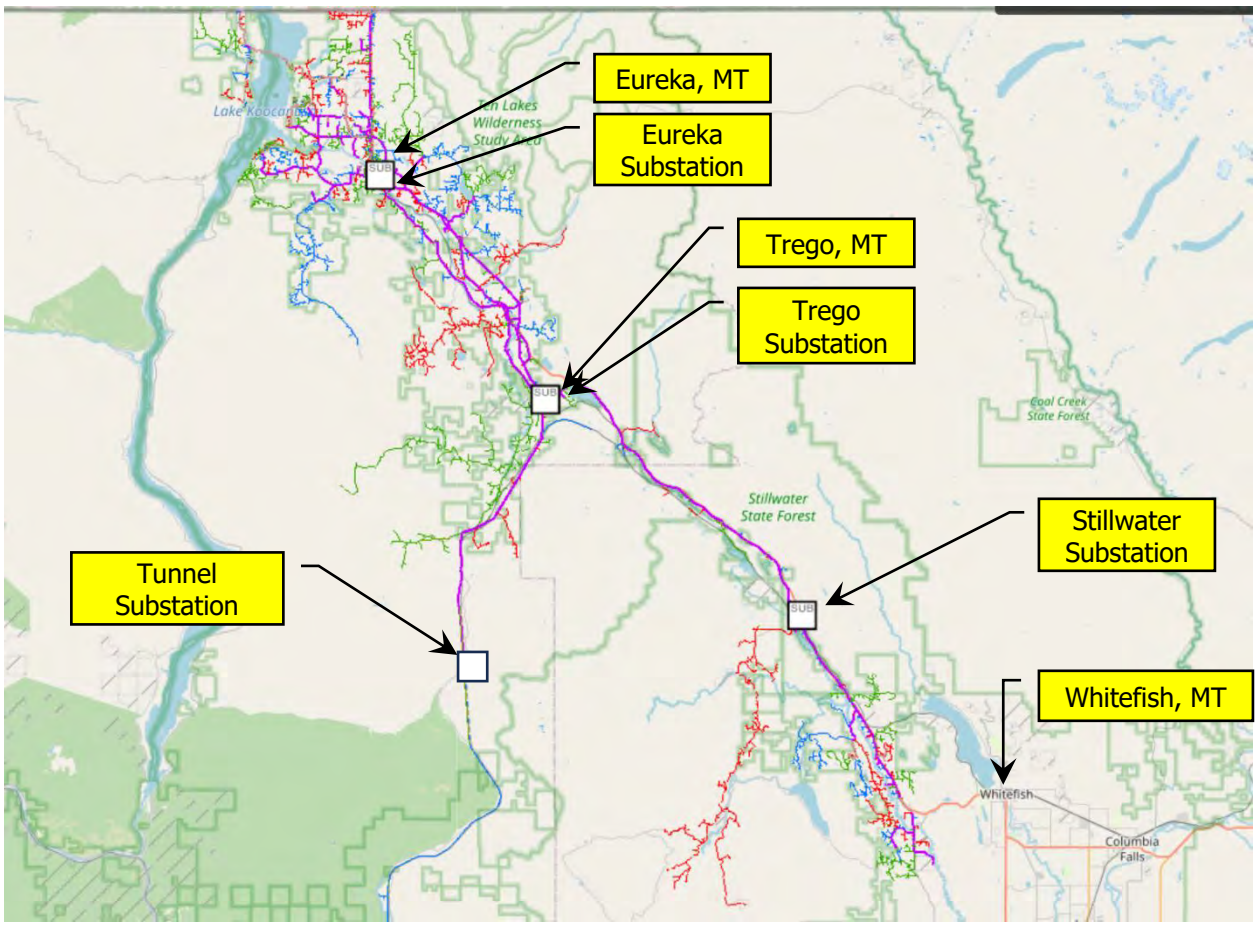


Figure 3 - LEC System Map

LEC information:

Miles of Overhead Transmission Power Line:	16.7 miles
Miles of Overhead Distribution Power Line:	482.3 miles
Miles of Underground Distribution Power Line:	521.6 miles
Total Miles of Distribution Power Line:	**1,003.9 miles**
System Voltage:	115 kV Transmission 14.4/24.9 kV Distribution
Total Number of Meters:	**6,993**

4. Biomass Power Plant Data

Per information provided by Zach Maasen, PMP, PE, Project Manager at HDR, the biomass plant was studied and modeled using the following information:

Rating:	3.5 MW
Estimated Output:	2.5 MW
Annual Operating Days:	350 days ±20%
Comments:	This facility could operate similarly to the Stoltz plant in Columbia Falls, Montana, served by Flathead Electric Cooperative.

5. Possible Biomass Power Plant Locations

Lincoln County asked LEC to study two locations for the biomass power plant.

5.1. Site 1: Industrial Park, North of the Town of Eureka

The first location is at the Industrial Park, property owned by Lincoln County. LEC provides three-phase backbone primary power to Industrial Park lots. Power is delivered to the area via the EXN Feeder out of the Eureka Substation. The EXN is comprised of both overhead and underground three-phase power lines spanning approximately 4.8 miles to reach Site 1 (Figure 4).

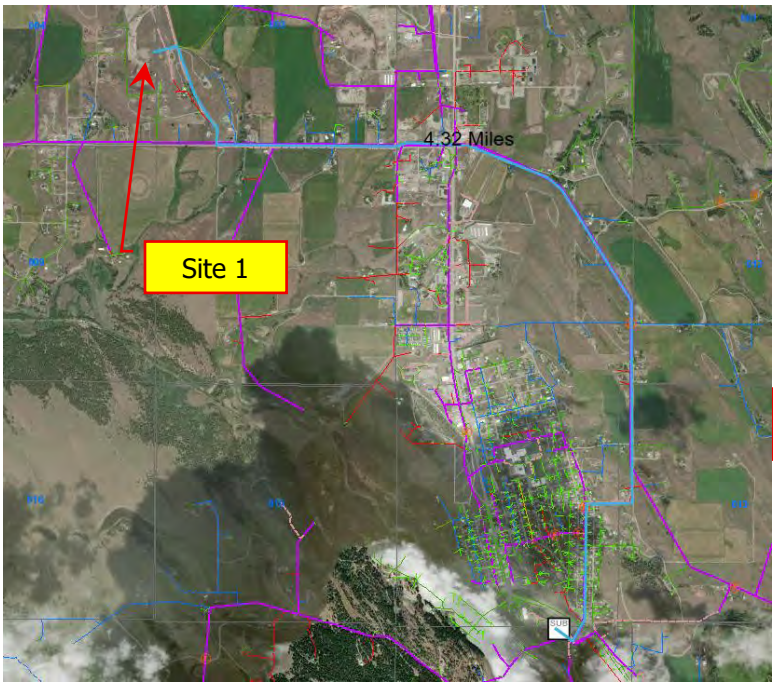


Figure 4 - Site 1 Miles to Eureka Substation

Per discussions with Mr. Maasen, it was mutually decided that Site 1 would not be evaluated in this study due to the distance from the substation and the combination of overhead to underground power lines.

5.2. Site 2: Former Plum Creek Timber Property, Southeast of Fortine, Montana

Site 2 was chosen for this study due to its proximity to the Trego Substation and the entire feeder serving the site is overhead power line. Located approximately one mile southeast of Fortine, Montana, Site 2 is a wide-open parcel that used to be home to the Plum Creek Timber company. LEC has four miles of overhead power line (known as the J Feeder) that used to serve the lumber company from the Trego Substation (Figure 5). Site 2 will be referred to as the "Study Site" from this point forward.

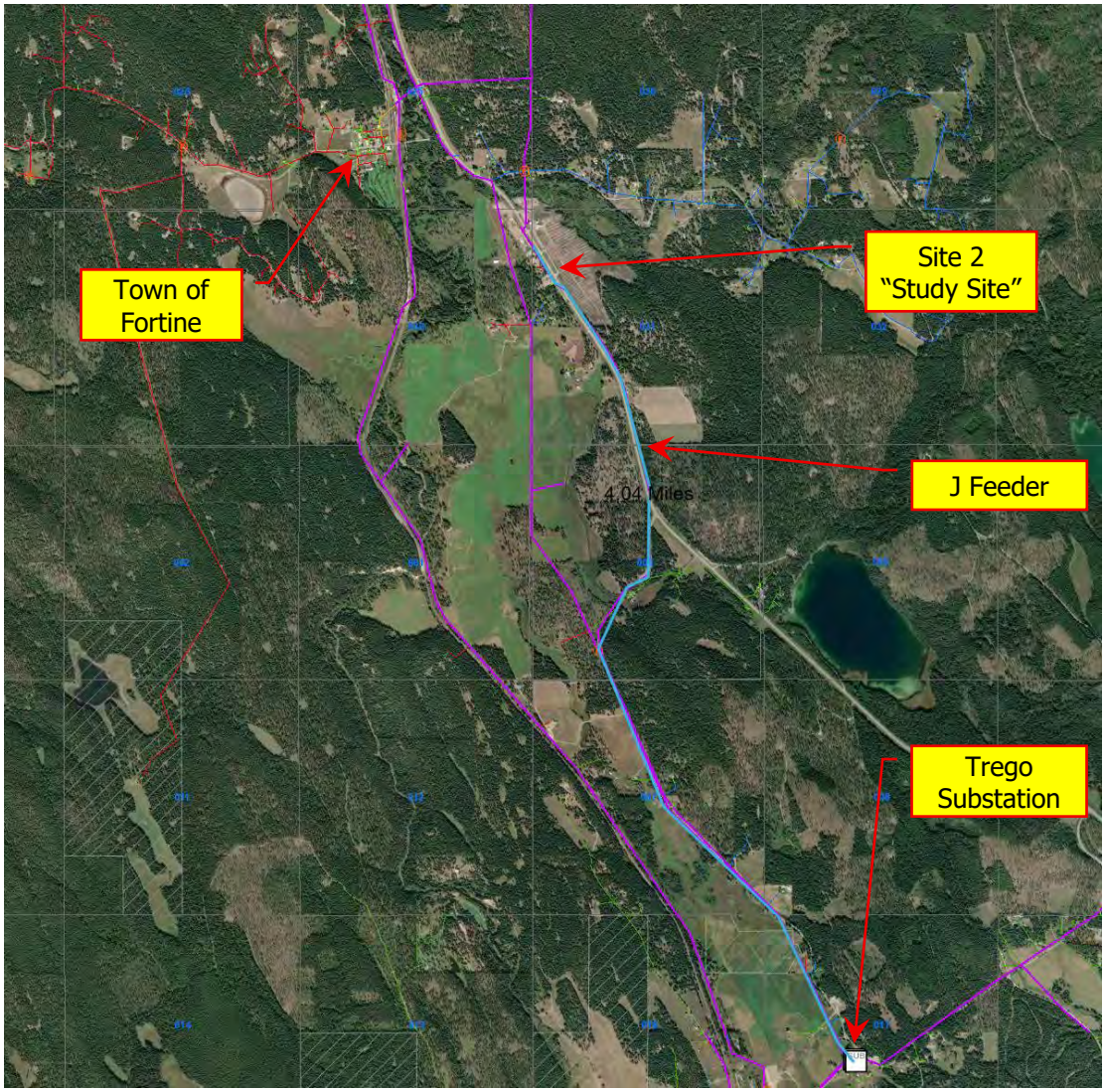


Figure 5 - Site 2 Location

6. Model

The analysis used LEC's Milsoft WindMil winter model since it reflects the most power usage at the service points. Figure 6 shows the Study Site, the J Feeder, and the Trego Substation relative to LEC's entire distribution system in the WindMil model.

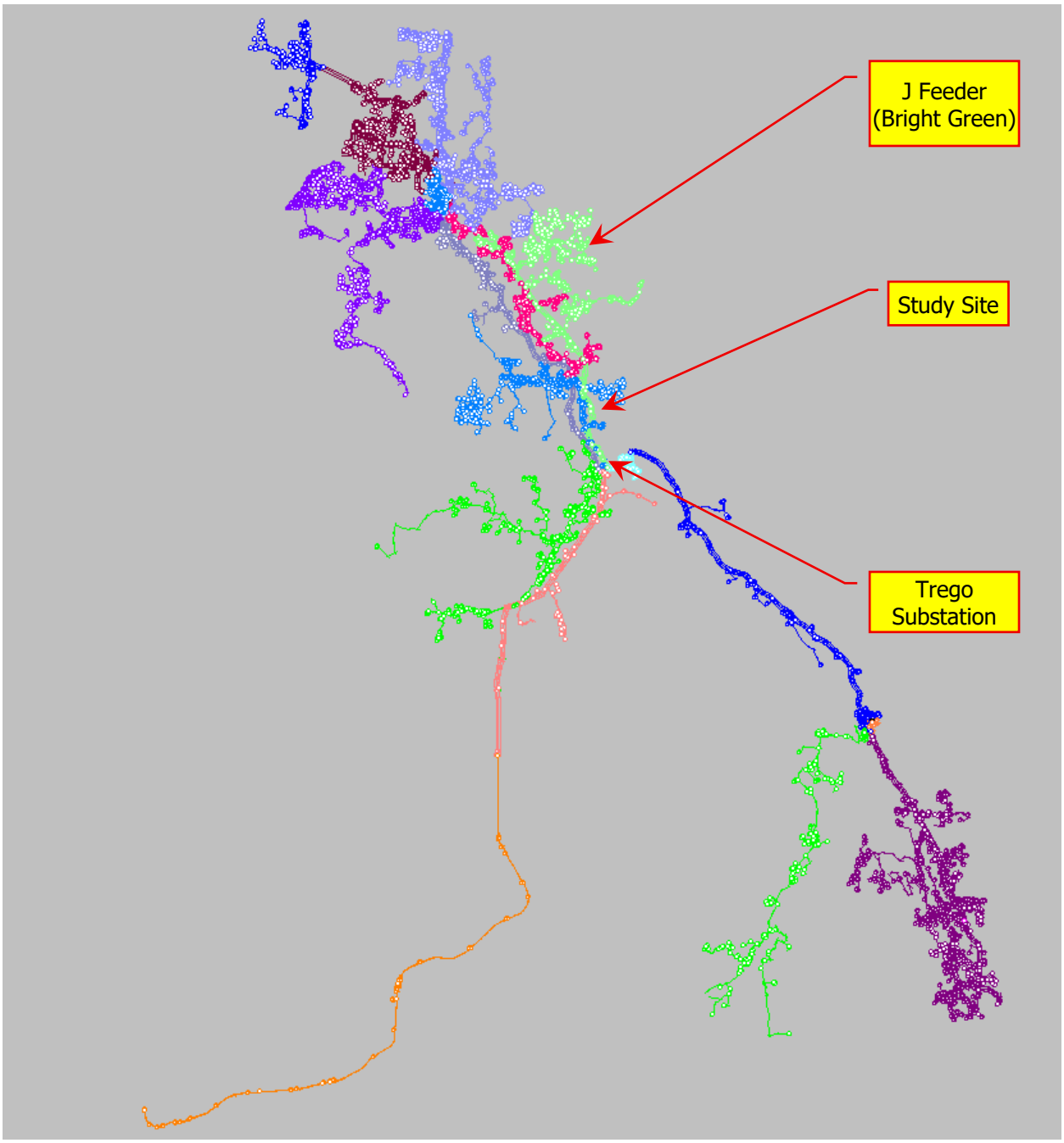


Figure 6 - LEC WindMil Model Distribution System

7. Test Points

The first step was to establish testing points along the J Feeder to record voltage, amperage, kilowatts, kiloVARs, and conductor capacity during the different analyses. Testing points were established along the feeder at the following circuit locations:

Location	Description
J3	Outside the Trego Substation.
J53	Three-phase point just prior to the new generator tap.
J61X	The new three-phase tap point for the new modeled generator.
J61X-R1	A new tap created in the model for the Study Site generator.
J116	Three-phase point after the new generator tap, with existing long single-phase taps.
J116-R50	Single-phase location near the end of the J116 right tap.
J187	Three-phase point after J116, with a heavily loaded three-phase tap serving the Glen Lake area.
J187-R49-R24-R36	The last and longest service off the J187 tap.

Table 1 - Analysis Test Points

The three-phase circuit locations were chosen to show load flow and capacity. The single-phase endpoints were chosen to show worst case voltage drop problems.

Figure 7 (next page) shows the test locations on the J Feeder model diagram.

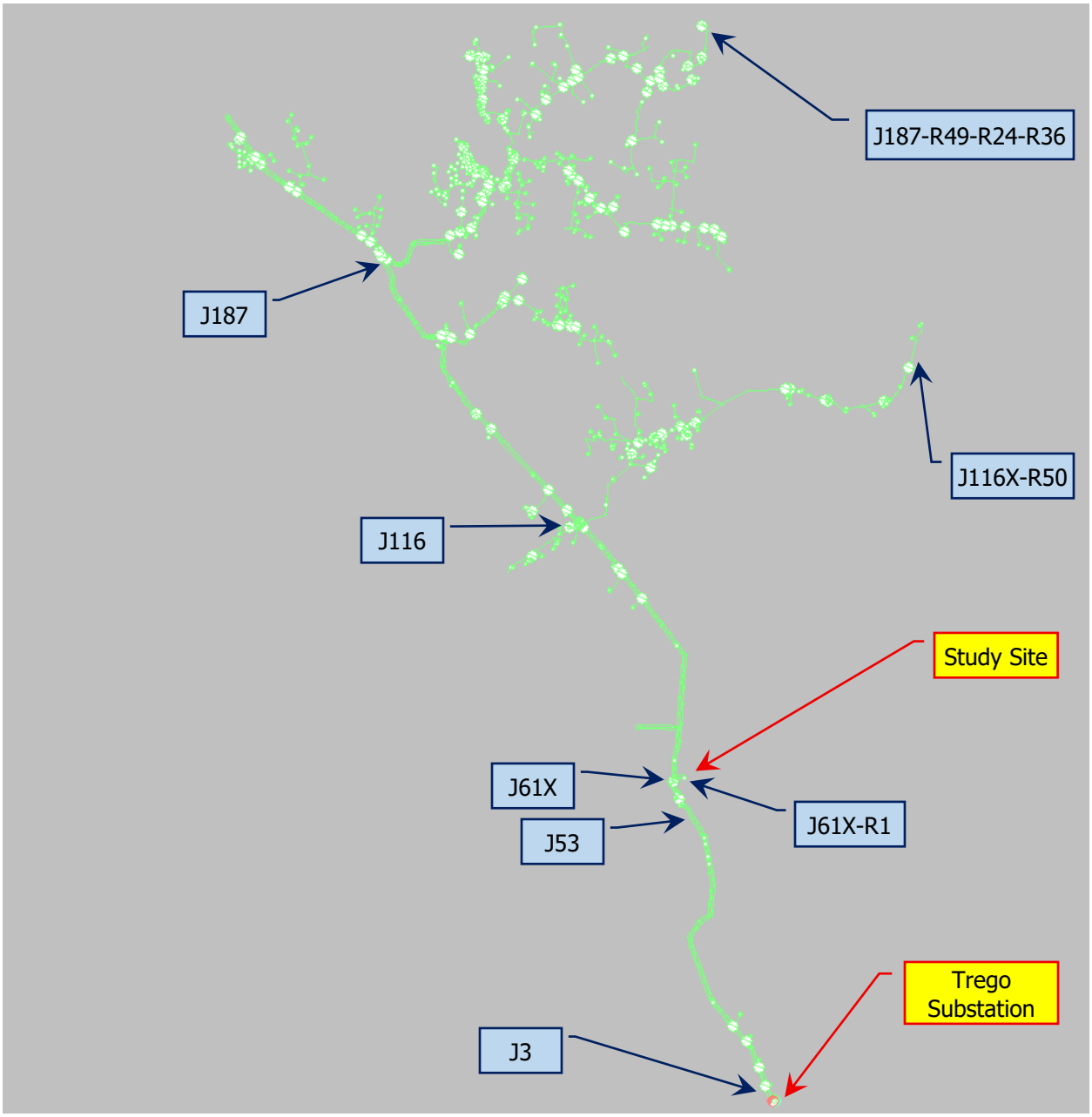


Figure 7 - WindMil Model of the J Feeder Showing the Test Points with the BPP Added

8. BPP Power Production

The following exert from an email correspondence[1] from Mr. Maasen discusses how the BPP power production should be modeled:

> Response from my lead designer:
>
> The generator configuration for the facility has not yet been finalized, so we do not have a confirmed power factor capability curve at this stage. The potential plant is anticipated to utilize a synchronous generator with automatic voltage regulation and the ability to adjust reactive power output within the generator's design limits. As such, the facility is not expected to be limited to operation at a fixed power factor. Once the generator OEM and turbine-generator package are selected, we can provide the reactive capability curve and operating limits for use in the interconnection study. However, for the purposes of preliminary modeling, it would be reasonable to assume the facility will operate over a typical utility generator reactive range (0.9 PF and above leading or lagging)
>
> Let's go with 2.5MW for 350 days/year +/- 20% (daily).

9. Load and Generator Scenarios

The following table outlines the different circuit loading and BPP output scenarios used for the analysis.

Scenario 1: J Feeder - Normal Winter Load BPP – No Output	The first scenario will establish the baseline capacity and voltages along the test points using the model's normal winter loads and no BPP output. The winter loads represent the largest normal loading as LEC is a winter peaking system.
Scenario 2: J Feeder – 10 Year Growth BPP – No Output	The circuit loading was grown to 25% to simulate ten years at a 2.5 percent (2.5%) annual growth rate.
Scenario 3: J Feeder – 10 Year Growth BPP – 2.5 MW	The circuit is at the ten-year growth mark, with the BPP producing 2.5 MW of power at 90% power factor.
Scenario 4: J Feeder – 10 Year Growth BPP – 3.5 MW	The circuit is at the ten-year growth mark, with the BPP producing 3.5 MW (full name plate rating) of power at 90% power factor.

Table 2 - Circuit Loading and BPP Output Scenarios

[1] July 16, 2026

10. Analysis Results

The following Tables 3, 4, 5 and 6 show the analysis results at the test points for the four loading scenarios:[2]

Scenario	Test Point	Phasing	Voltage (V)	Amperage (Amps)	Kilowatts (kW)	kiloVARS (kVAR)	Power Factor (%)	Conductor Capacity (%)
Scenario 1	J3	A Phase	125.9	70.2	1,048.6	166.6	98.8	30.5
		B Phase	125.9	64.2	949.2	204.4	97.8	27.9
		C Phase	125.9	77.0	1,155.1	146.1	99.2	33.5
Scenario 1	J53	A Phase	123.9	69.2	1,017.9	154.6	98.9	30.1
		B Phase	124.0	62.6	911.8	192.8	97.8	27.2
		C Phase	123.8	75.7	1,117.1	132.4	99.3	32.9
Scenario 1	J61X	A Phase	123.6	67.0	984.4	139.0	99.0	29.1
		B Phase	123.7	61.3	891.4	182.7	98.0	26.6
		C Phase	123.4	74.6	1,098.5	122.2	99.4	32.4
Scenario 1	J61X-R1	A Phase	123.6	(0.0)	(0.0)	(0.2)	8.5	0.0
		B Phase	123.7	(0.0)	0.0	(0.2)	(0.5)	0.0
		C Phase	123.4	(0.0)	0.0	(0.2)	(7.8)	0.0
Scenario 1	J116	A Phase	121.9	66.7	966.1	133.7	99.1	29.0
		B Phase	121.9	60.7	870.8	178.0	98.0	26.4
		C Phase	121.4	73.3	1,062.2	111.4	99.5	31.9
Scenario 1	J116-R50	A Phase	120.7	1.2	17.0	4.9	96.0	0.5
		B Phase	-	-	-	-	-	-
		C Phase	-	-	-	-	-	-
Scenario 1	J187	A Phase	121.0	35.6	507.8	95.7	98.3	15.5
		B Phase	119.5	57.2	804.1	161.7	98.0	24.9
		C Phase	119.6	53.7	768.8	55.4	99.7	23.4
Scenario 1	J187...R36	A Phase	-	-	-	-	-	-
		B Phase	115.3	1.1	15.0	4.5	95.8	0.8
		C Phase	-	-	-	-	-	-

Table 3 - Scenario 1 Analysis Results

[2] NOTE: LEC's line to ground distribution voltage is 14,400 volts. The model uses a 120 volt basis for the analysis and results.

Scenario	Test Point	Phasing	Voltage (V)	Amperage (Amps)	Kilowatts (kW)	kiloVARS (kVAR)	Power Factor (%)	Conductor Capacity (%)
Scenario 2	J3	A Phase	125.9	90.0	1,330.0	284.6	97.8	39.1
		B Phase	125.9	83.2	1,218.1	315.3	96.8	36.2
		C Phase	125.9	99.1	1,469.7	289.8	98.1	43.1
Scenario 2	J53	A Phase	123.3	88.7	1,285.5	262.9	98.0	38.6
		B Phase	123.4	81.2	1,165.7	295.7	96.9	35.3
		C Phase	123.0	97.5	1,414.8	264.0	98.3	42.4
Scenario 2	J61X	A Phase	122.9	85.8	1,242.7	242.3	98.2	37.3
		B Phase	123.0	79.5	1,139.4	282.4	97.1	34.6
		C Phase	122.5	96.0	1,390.5	250.0	98.4	41.8
Scenario 2	J61X-R1	A Phase	122.9	(0.0)	(0.0)	(0.2)	8.5	0.0
		B Phase	123.0	(0.0)	0.0	(0.2)	(0.6)	0.0
		C Phase	122.5	(0.0)	0.0	(0.2)	(7.8)	0.0
Scenario 2	J116	A Phase	120.5	85.4	1,214.6	229.2	98.3	37.1
		B Phase	120.7	78.8	1,108.9	271.9	97.1	34.3
		C Phase	119.8	94.4	1,338.4	227.9	98.6	41.0
Scenario 2	J116-R50	A Phase	119.0	1.6	21.3	6.8	95.3	0.7
		B Phase	-	-	-	-	-	-
		C Phase	-	-	-	-	-	-
Scenario 2	J187	A Phase	119.3	45.7	638.1	143.9	97.6	19.9
		B Phase	117.5	74.3	1,018.9	244.5	97.2	32.3
		C Phase	117.3	69.2	965.2	133.5	99.1	30.1
Scenario 2	J187...R36	A Phase	-	-	-	-	-	-
		B Phase	112.1	1.5	18.8	5.8	95.6	1.0
		C Phase	-	-	-	-	-	-

Table 4 - Scenario 2 Analysis Results

Scenario	Test Point	Phasing	Voltage (V)	Amperage (Amps)	Kilowatts (kW)	kiloVARS (kVAR)	Power Factor (%)	Conductor Capacity (%)
Scenario 3	J3	A Phase	124.9	36.0	471.3	261.7	87.4	15.6
		B Phase	124.0	31.8	364.0	303.5	76.8	13.8
		C Phase	124.5	44.4	608.0	266.3	91.6	19.3
Scenario 3	J53	A Phase	123.8	34.8	448.1	258.0	86.7	15.1
		B Phase	122.9	30.1	330.3	296.5	74.4	13.1
		C Phase	123.0	42.9	577.1	260.9	91.1	18.7
Scenario 3	J61X	A Phase	123.7	31.9	408.6	240.2	86.2	13.9
		B Phase	122.8	28.4	306.7	285.0	73.3	12.4
		C Phase	122.8	41.4	556.5	250.2	91.2	18.0
Scenario 3	J61X-R1	A Phase	123.7	(56.1)	(833.0)	1.8	(100.0)	24.4
		B Phase	122.8	(56.5)	(833.0)	1.8	(100.0)	24.6
		C Phase	122.8	(56.5)	(833.0)	1.8	(100.0)	24.6
Scenario 3	J116	A Phase	121.4	84.8	1,214.1	225.8	98.3	36.8
		B Phase	120.5	79.0	1,109.4	272.7	97.1	34.3
		C Phase	120.1	94.1	1,338.1	226.5	98.6	40.9
Scenario 3	J116-R50	A Phase	119.8	1.6	21.3	6.7	95.4	0.7
		B Phase	-	-	-	-	-	-
		C Phase	-	-	-	-	-	-
Scenario 3	J187	A Phase	120.2	45.3	637.9	142.6	97.6	19.7
		B Phase	117.3	74.4	1,019.2	245.1	97.2	32.4
		C Phase	117.6	69.0	965.0	132.4	99.1	30.0
Scenario 3	J187...R36	A Phase	-	-	-	-	-	-
		B Phase	111.9	1.5	18.8	5.8	95.6	1.0
		C Phase	-	-	-	-	-	-

Table 5 - Scenario 3 Analysis Results

Scenario	Test Point	Phasing	Voltage (V)	Amperage (Amps)	Kilowatts (kW)	kiloVARS (kVAR)	Power Factor (%)	Conductor Capacity (%)
Scenario 4	J3	A Phase	123.3	20.1	136.5	264.6	45.8	8.7
		B Phase	122.8	20.9	29.9	307.0	9.7	9.1
		C Phase	123.4	25.7	270.7	267.0	71.2	11.2
Scenario 4	J53	A Phase	122.9	19.5	115.6	263.1	40.2	8.5
		B Phase	122.3	20.5	(1.8)	300.6	(0.6)	8.9
		C Phase	122.5	24.5	244.0	265.2	67.7	10.7
Scenario 4	J61X	A Phase	122.9	17.4	76.4	245.7	29.7	7.6
		B Phase	122.2	19.8	(25.1)	289.1	(8.7)	8.6
		C Phase	122.3	23.1	224.0	255.0	66.0	10.1
Scenario 4	J61X-R1	A Phase	122.9	(79.1)	(1,166.0)	3.7	(100.0)	34.4
		B Phase	122.2	(79.5)	(1,166.0)	3.7	(100.0)	34.6
		C Phase	122.3	(79.5)	(1,166.0)	3.8	(100.0)	34.5
Scenario 4	J116	A Phase	120.6	85.4	1,214.6	229.0	98.3	37.1
		B Phase	119.9	79.5	1,110.3	274.7	97.1	34.6
		C Phase	119.6	94.6	1,338.4	229.2	98.6	41.1
Scenario 4	J116-R50	A Phase	119.0	1.6	21.3	6.8	95.3	0.7
		B Phase	-	-	-	-	-	-
		C Phase	-	-	-	-	-	-
Scenario 4	J187	A Phase	119.3	45.7	638.1	143.8	97.6	19.9
		B Phase	116.7	74.9	1,019.8	246.8	97.2	32.6
		C Phase	117.1	69.4	965.2	134.3	99.0	30.2
Scenario 4	J187...R36	A Phase	-	-	-	-	-	-
		B Phase	111.2	1.5	18.8	5.8	95.6	1.1
		C Phase	-	-	-	-	-	-

Table 6 - Scenario 4 Analysis Results

Analysis parameters:

Base voltage: 120 volts
BPP Power Factor: 100% Unity
BPP Output: 2.5 MW Scenario 3
3.5 MW Scenario 4
Balanced output
Regulation: No regulation or capacitor banks were installed at the J61X tap or the BPP

11. Key Findings

The most notable analysis result is that the J Feeder can sustain the BPP load without any conductor upgrades. Since the feeder formerly served the Plum Creek Mill facilities, the conductor is 1/0 ACSR, capable of 242 amps per phase.[3] Figure 8 below shows the conductor capacity being used during each scenario. The worst case of 43% loading happened prior to the BPP coming online and the system grown over ten years.

If all LEC's native loads were offline and the BPP was at full output, the J Feeder would only be loaded 38% with the back feed amperage.[4]

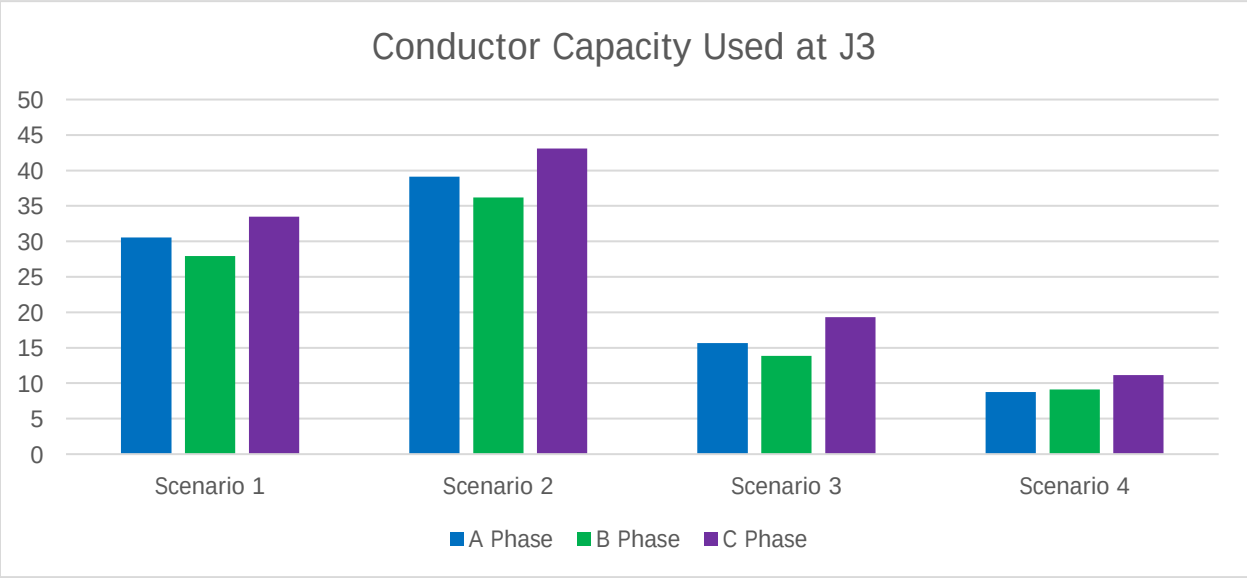


Figure 8 - Used Conductor Capacity at J3 (%)

Likewise, the J feeder loading decreased at the Trego Substation to the J61X test point because the BPP was producing part of the required circuit power in scenarios three and four (Figure 9, next page).

It is important to note that this was using LEC's fully loaded ten year growth winter model. As shown in Scenario 4, the J Feeder and the Trego Substation could see negative power flow, or "back feed", at both 2.5 and 3.5 MW outputs during low usage months.

[3] This does not include any derating required by the NESC.
[4] 79.1 amps from the BPP divided by 242 full load conductor amperage rating.

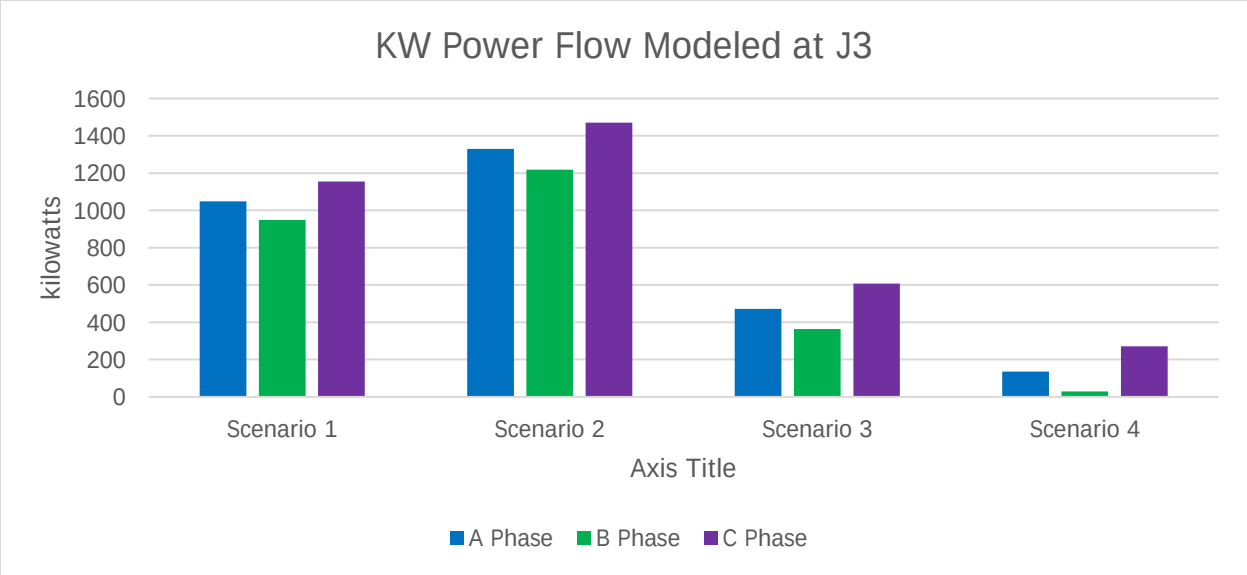


Figure 9 - J Feeder Power Flow (kW)

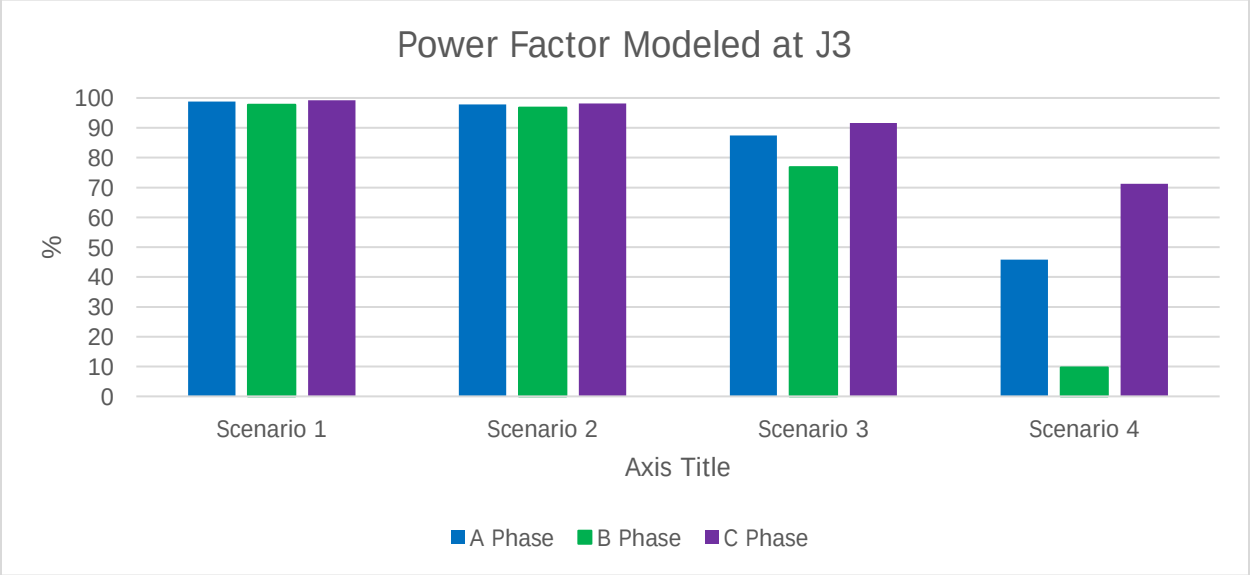


Figure 10 - Power Factor Results (%)

Figure 10 displays the power factor (PF) analysis results. Power factor is the ratio of kilowatts to apparent power (kW/kVA). Kilowatts (kW) is the useful power doing the work. Reactive power (kVAR) is a form of power not metered but required in power lines to maintain magnetic fields in motors and transformers. Apparent power (kVA) is the total power the system must supply and is a function of both kilowatts and kVARS.

For utilities such as LEC, staying close to 100% is ideal because it is the measure of how efficiently power is utilized.[5]

Prior to the BPP coming online, the power factor at the Trego Substation was near unity, or 100%. However, when the BPP comes online at 2.5 MW, the power factor drops down near or below 90%. At 3.5 MW, is nearly 70% on C phase, 45% on A phase, and only 10% on B phase.

This reason the power factor dropped was because the BPP was modeled with no reactive power output. Typically, most generators can supply kVAR output to match the utility system needs. However, the BPP reactive power output was not provided for this study, thus not modeled. The Trego Substation power factor declined during the analysis because the BPP was providing kilowatt power to the feeder, the substation had to continue to supply the reactive power. Therefore, the power factor ratios declined at the source.

As a customer of the Bonneville Power Administration, LEC is required to maintain power factors above 90% without paying penalties. If Lincoln County were to pursue further BPP studies, full power and reactive power output data will be required to maintain LEC's power factor above 90%.

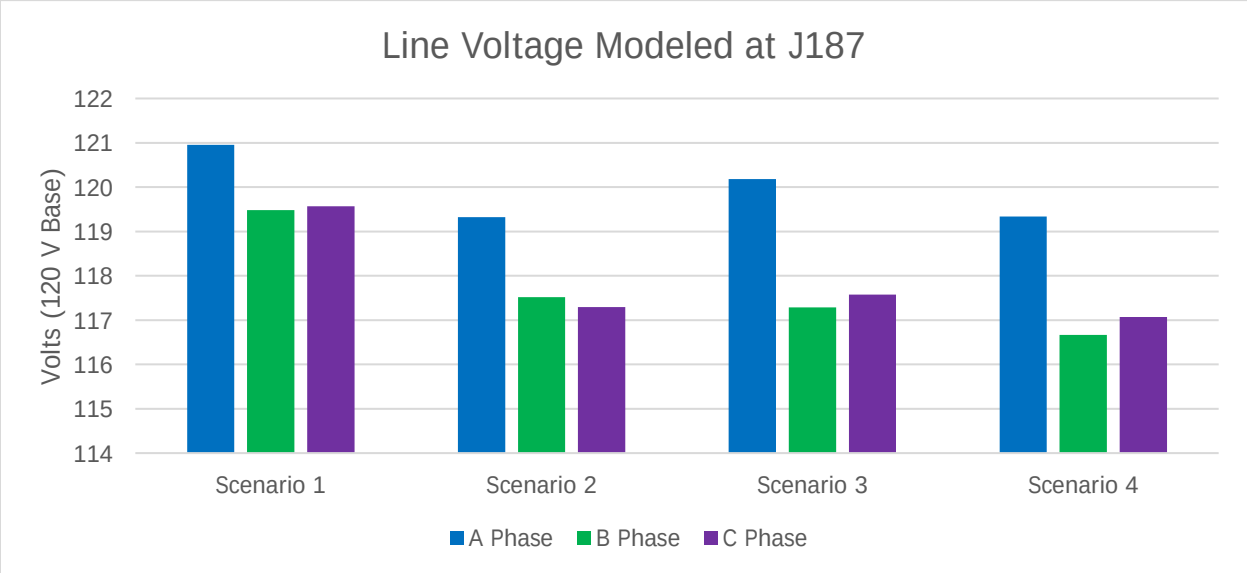


Figure 11 - Line Voltage at the End of Feeder (V)

LEC also studied the voltage at the end of the feeder at test point J187 (Figure 11). Using the 120-volt basis, the BPP did lower the voltage when online, but within acceptable ranges. System voltage is also dependent upon reactive power flow. This

[5] To learn more about power factor, go to: Power Factor Explained - The Engineering Mindset

analysis again could vary depending upon how much reactive power the BPP produces. Line regulators may be required along the feeder to bring the line voltage closer to 120 volts.

There are three regulators at the Trego Substation to maintain the J Feeder line voltage. If a BPP is installed, these will have to be upgraded to manage the voltage during reverse power flow situations.

12. Cost Estimates

According to the analysis, the J Feeder power line has adequate capacity for the BPP. The numbers in Table 7 outline the equipment and costs needed to interconnect the system. All costs were projected to 2028 using standard LEC growth rates.

Line Extension, Power Transformer, Metering, etc.:	$311,900
Protective Equipment:	$45,000
Regulator Upgrade at Substation:	$190,700
Regulator Installation North of BPP:	$201,000
Remote Control, Diagnostic, & Communication Systems:	$50,000
Total:	$798,600

Table 7 - LEC Cost Estimate, 2028 Basis, Rounded to Nearest $100

All costs in Table 7 are preliminary based upon limited information and assumptions by HDR and are for discussion purposes only. *This information should not be considered binding. If Lincoln County chooses to move forward with this project, or one of similar nature, they must follow LEC's application process. LEC will then do a detailed design, cost estimate, and associated agreements at Lincoln County's expense.*

The first line estimates the cost for LEC to extend the feeder to the approximate site location. This consists of both overhead and underground power lines terminating at a pad-mounted three-phase transformer near the BPP.

Line two notes the cost to install three-phase protection equipment in the event the BPP fails or causes power quality issues.

In the event the BPP produces more power than the J Feeder requires, the substation regulators and controls must be upgraded to accommodate the reverse power flow. This cost is shown in line three.

Since the BPP can also vary the voltage levels on the system, LEC may require another set of regulators north of the project site, as shown in line four.

The last item in the cost estimate accounts for any control and communication equipment that may be required for LEC to interface with the BPP.

These costs will change based upon actual design.

13. Conclusion

In conclusion, LEC's J Feeder is capable to support a biomass power project without upgrading the power line. There would be costs associated with interconnecting the system to ensure adequate voltage and power quality standards are maintained. If this project should move forward, LEC will require Lincoln County to apply so that the system can be properly designed. An interconnection study with the Bonneville Power Administration will also be required.

This study is only to analyze the interconnection aspects of the project. LEC neither expresses nor implies that if the power facility is constructed that they will enter into a purchase power agreement with Lincoln County and/or associated partners. As a member of PNGC, LEC has contracted all required power needs for the near- and long-term future.

Lincoln Electric Cooperative welcomes any discussion regarding this study and further exploration.

14. Contact Information

For clarification or more information about this study, please contact:

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Eureka, MT 59917

Web: www.LincolnElectric.coop

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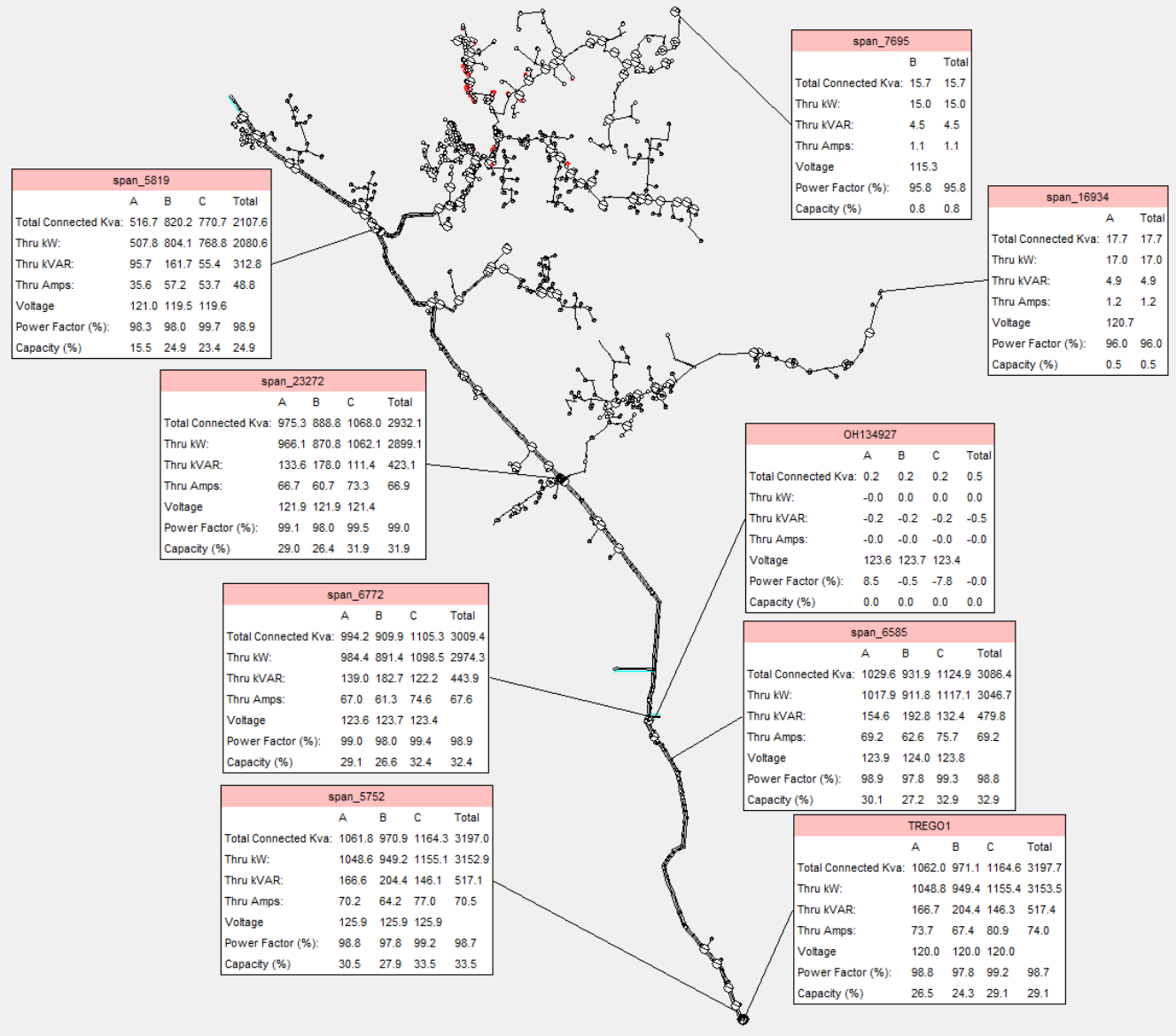
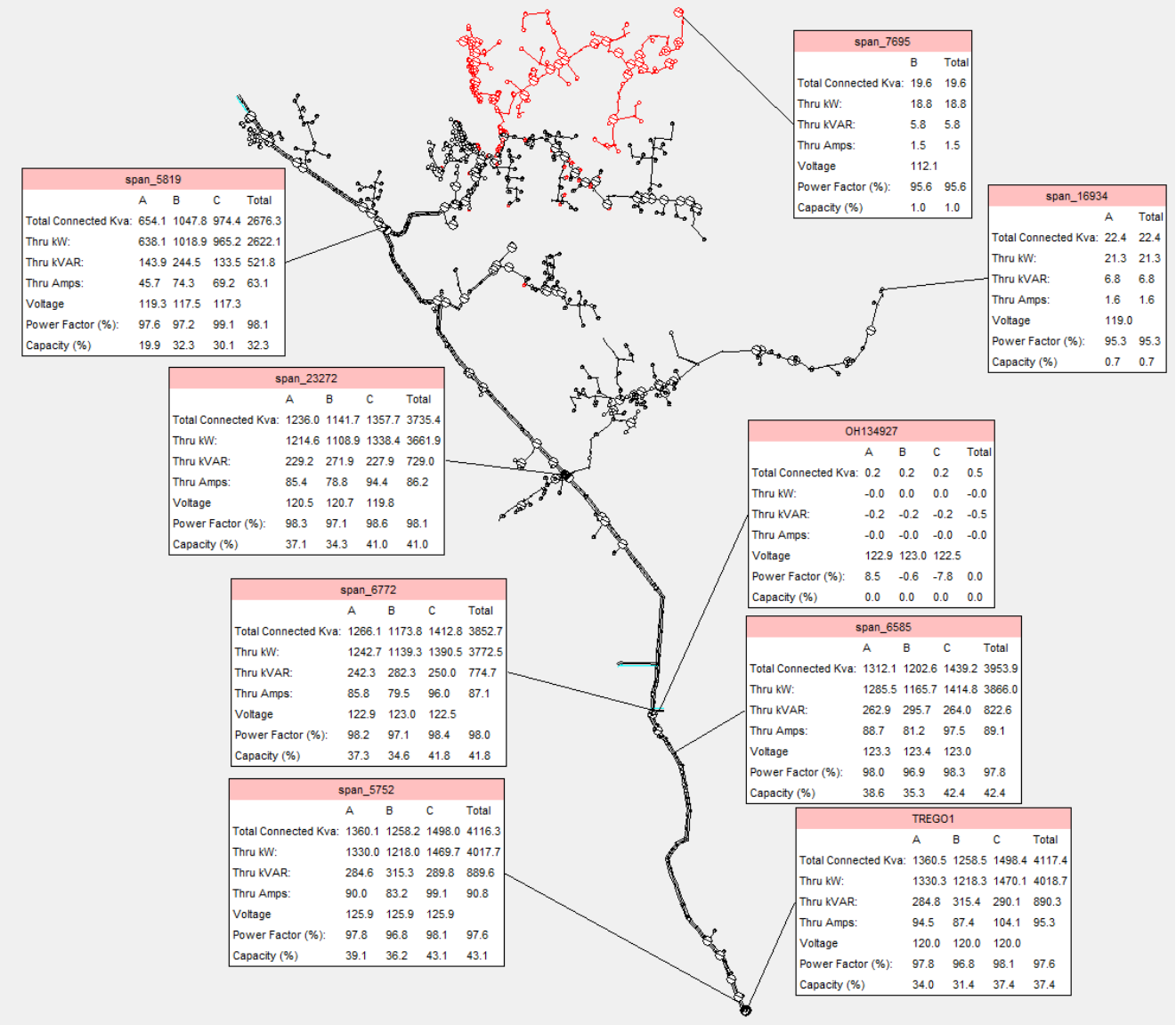
15. Appendix – WindMil Analysis Visual Outputs

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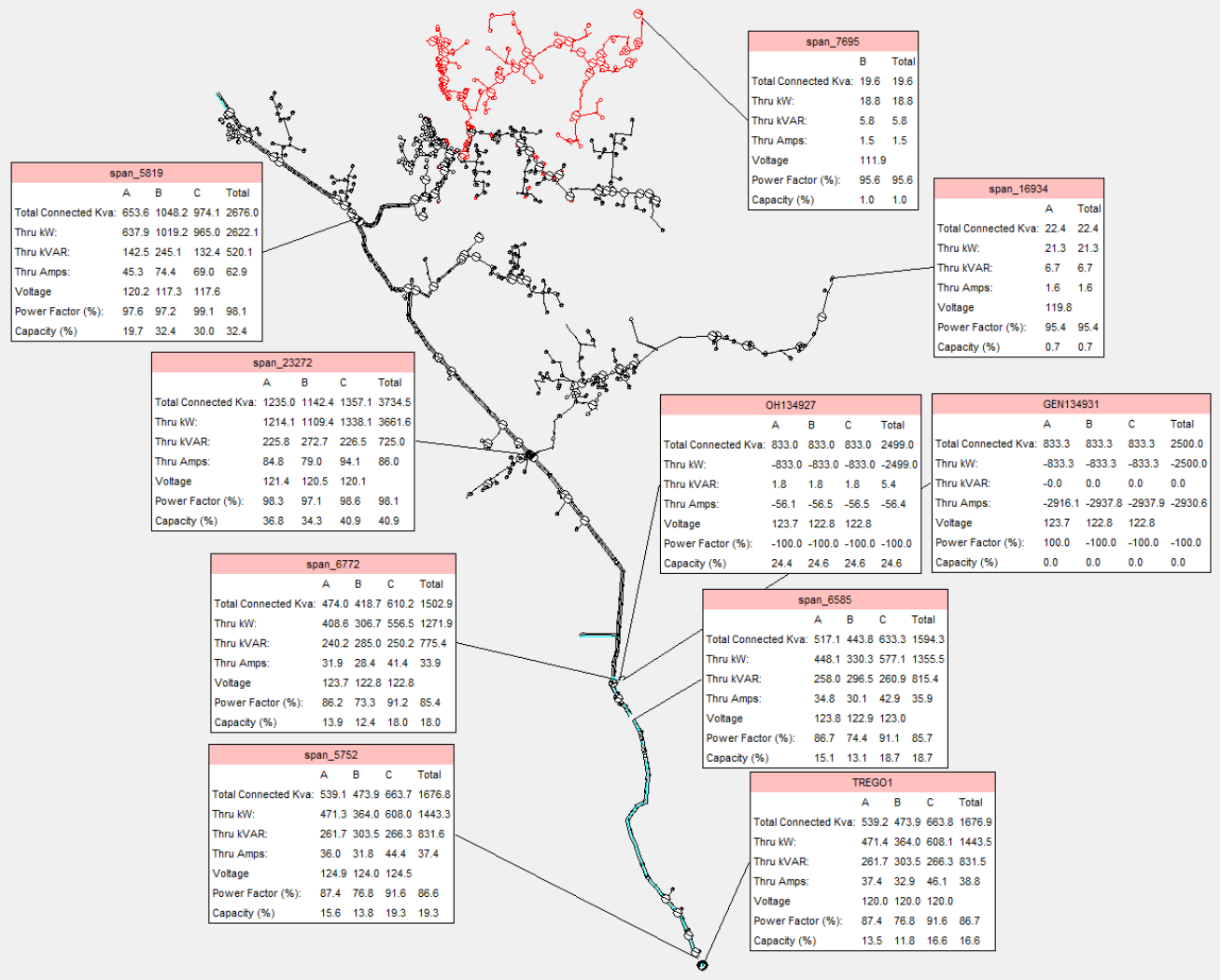
B Total
Total Connected Kva: 19.6 19.6
Thru kW: 18.8 18.8
Thru kVAR: 5.8 5.8
Thru Amps: 1.5 1.5
Voltage 112.1
Power Factor (%): 95.6 95.6
Capacity (%) 1.0 1.0
span_5819
A B C Total
Total Connected Kva: 654.1 1047.8 974.4 2676.3
Thru kW: 638.1 1018.9 965.2 2622.1
Thru kVAR: 143.9 244.5 133.5 521.8
Thru Amps: 45.7 74.3 69.2 63.1
Voltage 119.3 117.5 117.3
Power Factor (%): 97.6 97.2 99.1 98.1
Capacity (%) 19.9 32.3 30.1 32.3
span_16934
A Total
Total Connected Kva: 22.4 22.4
Thru kW: 21.3 21.3
Thru kVAR: 6.8 6.8
Thru Amps: 1.6 1.6
Voltage 119.0
Power Factor (%): 95.3 95.3
Capacity (%) 0.7 0.7
span_23272
A B C Total
Total Connected Kva: 1236.0 1141.7 1357.7 3735.4
Thru kW: 1214.6 1108.9 1338.4 3661.9
Thru kVAR: 229.2 271.9 227.9 729.0
Thru Amps: 85.4 78.8 94.4 86.2
Voltage 120.5 120.7 119.8
Power Factor (%): 98.3 97.1 98.6 98.1
Capacity (%) 37.1 34.3 41.0 41.0
OH134927
A B C Total
Total Connected Kva: 0.2 0.2 0.2 0.5
Thru kW: -0.0 0.0 0.0 -0.0
Thru kVAR: -0.2 -0.2 -0.2 -0.5
Thru Amps: -0.0 -0.0 -0.0 -0.0
Voltage 122.9 123.0 122.5
Power Factor (%): 8.5 -0.6 -7.8 0.0
Capacity (%) 0.0 0.0 0.0 0.0
span_6772
A B C Total
Total Connected Kva: 1266.1 1173.8 1412.8 3852.7
Thru kW: 1242.7 1139.3 1390.5 3772.5
Thru kVAR: 242.3 282.3 250.0 774.7
Thru Amps: 85.8 79.5 96.0 87.1
Voltage 122.9 123.0 122.5
Power Factor (%): 98.2 97.1 98.4 98.0
Capacity (%) 37.3 34.6 41.8 41.8
span_6585
A B C Total
Total Connected Kva: 1312.1 1202.6 1439.2 3953.9
Thru kW: 1285.5 1165.7 1414.8 3866.0
Thru kVAR: 262.9 295.7 264.0 822.6
Thru Amps: 88.7 81.2 97.5 89.1
Voltage 123.3 123.4 123.0
Power Factor (%): 98.0 96.9 98.3 97.8
Capacity (%) 38.6 35.3 42.4 42.4
span_5752
A B C Total
Total Connected Kva: 1360.1 1258.2 1498.0 4116.3
Thru kW: 1330.0 1218.0 1469.7 4017.7
Thru kVAR: 284.6 315.3 289.8 889.6
Thru Amps: 90.0 83.2 99.1 90.8
Voltage 125.9 125.9 125.9
Power Factor (%): 97.8 96.8 98.1 97.6
Capacity (%) 39.1 36.2 43.1 43.1
TREGO1
A B C Total
Total Connected Kva: 1360.5 1258.5 1498.4 4117.4
Thru kW: 1330.3 1218.3 1470.1 4018.7
Thru kVAR: 284.8 315.4 290.1 890.3
Thru Amps: 94.5 87.4 104.1 95.3
Voltage 120.0 120.0 120.0
Power Factor (%): 97.8 96.8 98.1 97.6
Capacity (%) 34.0 31.4 37.4 37.4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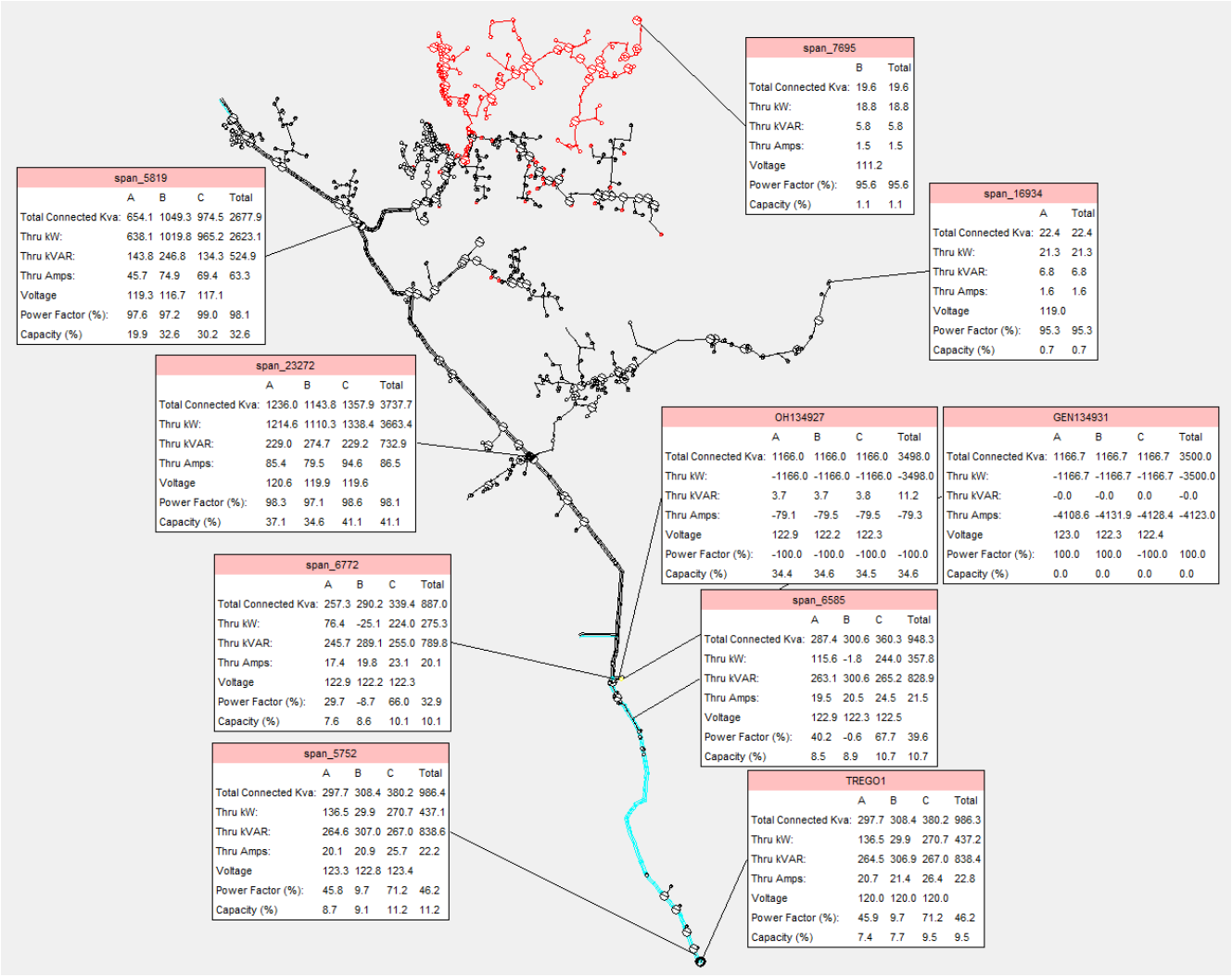
B Total
Total Connected Kva: 19.6 19.6
Thru kW: 18.8 18.8
Thru kVAR: 5.8 5.8
Thru Amps: 1.5 1.5
Voltage 111.9
Power Factor (%): 95.6 95.6
Capacity (%) 1.0 1.0
span_5819
A B C Total
Total Connected Kva: 653.6 1048.2 974.1 2676.0
Thru kW: 637.9 1019.2 965.0 2622.1
Thru kVAR: 142.5 245.1 132.4 520.1
Thru Amps: 45.3 74.4 69.0 62.9
Voltage 120.2 117.3 117.6
Power Factor (%): 97.6 97.2 99.1 98.1
Capacity (%) 19.7 32.4 30.0 32.4
span_16934
A Total
Total Connected Kva: 22.4 22.4
Thru kW: 21.3 21.3
Thru kVAR: 6.7 6.7
Thru Amps: 1.6 1.6
Voltage 119.8
Power Factor (%): 95.4 95.4
Capacity (%) 0.7 0.7
span_23272
A B C Total
Total Connected Kva: 1235.0 1142.4 1357.1 3734.5
Thru kW: 1214.1 1109.4 1338.1 3661.6
Thru kVAR: 225.8 272.7 226.5 725.0
Thru Amps: 84.8 79.0 94.1 86.0
Voltage 121.4 120.5 120.1
Power Factor (%): 98.3 97.1 98.6 98.1
Capacity (%) 36.8 34.3 40.9 40.9
OH134927
A B C Total
Total Connected Kva: 833.0 833.0 833.0 2499.0
Thru kW: -833.0 -833.0 -833.0 -2499.0
Thru kVAR: 1.8 1.8 1.8 5.4
Thru Amps: -56.1 -56.5 -56.5 -56.4
Voltage 123.7 122.8 122.8
Power Factor (%): -100.0 -100.0 -100.0 -100.0
Capacity (%) 24.4 24.6 24.6 24.6
GEN134931
A B C Total
Total Connected Kva: 833.3 833.3 833.3 2500.0
Thru kW: -833.3 -833.3 -833.3 -2500.0
Thru kVAR: -0.0 0.0 0.0 0.0
Thru Amps: -2916.1 -2937.8 -2937.9 -2930.6
Voltage 123.7 122.8 122.8
Power Factor (%): 100.0 -100.0 -100.0 -100.0
Capacity (%) 0.0 0.0 0.0 0.0
span_6772
A B C Total
Total Connected Kva: 474.0 418.7 610.2 1502.9
Thru kW: 408.6 306.7 556.5 1271.9
Thru kVAR: 240.2 285.0 250.2 775.4
Thru Amps: 31.9 28.4 41.4 33.9
Voltage 123.7 122.8 122.8
Power Factor (%): 86.2 73.3 91.2 85.4
Capacity (%) 13.9 12.4 18.0 18.0
span_6585
A B C Total
Total Connected Kva: 517.1 443.8 633.3 1594.3
Thru kW: 448.1 330.3 577.1 1355.5
Thru kVAR: 258.0 296.5 260.9 815.4
Thru Amps: 34.8 30.1 42.9 35.9
Voltage 123.8 122.9 123.0
Power Factor (%): 86.7 74.4 91.1 85.7
Capacity (%) 15.1 13.1 18.7 18.7
span_5752
A B C Total
Total Connected Kva: 539.1 473.9 663.7 1676.8
Thru kW: 471.3 364.0 608.0 1443.3
Thru kVAR: 261.7 303.5 266.3 831.6
Thru Amps: 36.0 31.8 44.4 37.4
Voltage 124.9 124.0 124.5
Power Factor (%): 87.4 76.8 91.6 86.6
Capacity (%) 15.6 13.8 19.3 19.3
TREGO1
A B C Total
Total Connected Kva: 539.2 473.9 663.8 1676.9
Thru kW: 471.4 364.0 608.1 1443.5
Thru kVAR: 261.7 303.5 266.3 831.5
Thru Amps: 37.4 32.9 46.1 38.8
Voltage 120.0 120.0 120.0
Power Factor (%): 87.4 76.8 91.6 86.7
Capacity (%) 13.5 11.8 16.6 16.6


span_7695
B Total
Total Connected Kva: 19.6 19.6
Thru kW: 18.8 18.8
Thru kVAR: 5.8 5.8
Thru Amps: 1.5 1.5
Voltage 111.2
Power Factor (%): 95.6 95.6
Capacity (%) 1.1 1.1
span_5819
A B C Total
Total Connected Kva: 654.1 1049.3 974.5 2677.9
Thru kW: 638.1 1019.8 965.2 2623.1
Thru kVAR: 143.8 246.8 134.3 524.9
Thru Amps: 45.7 74.9 69.4 63.3
Voltage 119.3 116.7 117.1
Power Factor (%): 97.6 97.2 99.0 98.1
Capacity (%) 19.9 32.6 30.2 32.6
span_16934
A Total
Total Connected Kva: 22.4 22.4
Thru kW: 21.3 21.3
Thru kVAR: 6.8 6.8
Thru Amps: 1.6 1.6
Voltage 119.0
Power Factor (%): 95.3 95.3
Capacity (%) 0.7 0.7
span_23272
A B C Total
Total Connected Kva: 1236.0 1143.8 1357.9 3737.7
Thru kW: 1214.6 1110.3 1338.4 3663.4
Thru kVAR: 229.0 274.7 229.2 732.9
Thru Amps: 85.4 79.5 94.6 86.5
Voltage 120.6 119.9 119.6
Power Factor (%): 98.3 97.1 98.6 98.1
Capacity (%) 37.1 34.6 41.1 41.1
OH134927
A B C Total
Total Connected Kva: 1166.0 1166.0 1166.0 3498.0
Thru kW: -1166.0 -1166.0 -1166.0 -3498.0
Thru kVAR: 3.7 3.7 3.8 11.2
Thru Amps: -79.1 -79.5 -79.5 -79.3
Voltage 122.9 122.2 122.3
Power Factor (%): -100.0 -100.0 -100.0 -100.0
Capacity (%) 34.4 34.6 34.5 34.6
GEN134931
A B C Total
Total Connected Kva: 1166.7 1166.7 1166.7 3500.0
Thru kW: -1166.7 -1166.7 -1166.7 -3500.0
Thru kVAR: -0.0 -0.0 0.0 -0.0
Thru Amps: -4108.6 -4131.9 -4128.4 -4123.0
Voltage 123.0 122.3 122.4
Power Factor (%): 100.0 100.0 -100.0 100.0
Capacity (%) 0.0 0.0 0.0 0.0
span_6772
A B C Total
Total Connected Kva: 257.3 290.2 339.4 887.0
Thru kW: 76.4 -25.1 224.0 275.3
Thru kVAR: 245.7 289.1 255.0 789.8
Thru Amps: 17.4 19.8 23.1 20.1
Voltage 122.9 122.2 122.3
Power Factor (%): 29.7 -8.7 66.0 32.9
Capacity (%) 7.6 8.6 10.1 10.1
span_6585
A B C Total
Total Connected Kva: 287.4 300.6 360.3 948.3
Thru kW: 115.6 -1.8 244.0 357.8
Thru kVAR: 263.1 300.6 265.2 828.9
Thru Amps: 19.5 20.5 24.5 21.5
Voltage 122.9 122.3 122.5
Power Factor (%): 40.2 -0.6 67.7 39.6
Capacity (%) 8.5 8.9 10.7 10.7
span_5752
A B C Total
Total Connected Kva: 297.7 308.4 380.2 986.4
Thru kW: 136.5 29.9 270.7 437.1
Thru kVAR: 264.6 307.0 267.0 838.6
Thru Amps: 20.1 20.9 25.7 22.2
Voltage 123.3 122.8 123.4
Power Factor (%): 45.8 9.7 71.2 46.2
Capacity (%) 8.7 9.1 11.2 11.2
TREGO1
A B C Total
Total Connected Kva: 297.7 308.4 380.2 986.3
Thru kW: 136.5 29.9 270.7 437.2
Thru kVAR: 264.5 306.9 267.0 838.4
Thru Amps: 20.7 21.4 26.4 22.8
Voltage 120.0 120.0 120.0
Power Factor (%): 45.9 9.7 71.2 46.2
Capacity (%) 7.4 7.7 9.5 9.5

Appendix D. Counties on Fire

Dear Lincoln County Resident,

Twenty-one years ago this summer Libby came within a whisker of burning to the ground.

Longtime residents will recall that the town was surrounded by wildfires and that – in hopes of averting disaster – the Forest Service railed fire trucks from Cleveland, Ohio. The trucks sat on a rail siding near the Burlington Northern train station for several days.

A change in wind direction saved us – not just Libby but Troy, Trego, Rexford and possibly Eureka. If you've moved here since 2000, you probably have no idea how much danger we face from the enormous accumulations of dying and dead trees standing in the Kootenai National Forest.

This booklet is designed to [1] help you understand the risks we are facing in Lincoln County, [2] encourage you to get involved in supporting Forest Service efforts to reduce our wildfire risk and [3] help you take the practical steps necessary to protect your home, family and property.

The map on the facing page outlines the Wildland Urban Interface [WUI] in our county.

Although the red outlined areas include all public and private lands ownerships, the areas at highest risk lie within the 2.2 million acre Kootenai National Forest. It is easily the most dominant land feature within our beautiful county.

A 2019 WUI study ranks Lincoln County in the 97th and 98th percentiles for existing and potential wildfire risk. Our WUI area is the largest in Montana and we also have the largest percentage of primary and secondary homes within a Montana WUI. Clearly, we are living on borrowed time.

The bar graphs on Page 7 in this report quantify annual gross growth, mortality and net growth for the Kootenai National Forest. The Forest Service's Forest Inventory and Analysis [FIA] program gathers this data from survey plots that it monitors on every national forest in Montana, including the Kootenai.

The news is frightening. 363,433,844 board feet of timber die annually on the Kootenai. Equal to 236,611 cords of wood. Converted to gallons of gasoline, 226,556,163 gallons stacked on our doorstep. Every gallon packs the explosive power of 83 sticks of dynamite! In total, 18,804,991,529 sticks of dynamite – a powder keg search of an ignition source: a lightning strike or an errant campfire.

The bar graphs on Page 5 reveal that the news is even worse for all national forests in Montana combined. Net growth is negative 1,412,884,770 billion board feet! 919,847 cords of dead wood. Unimaginable but sadly true.

We believe the Forest Service wants to do a better job of managing Montana national forests in its care, but it needs a strong showing of public support for doing the thinning and stand tending work necessary to reduce the high risk of wildfire in our forests.

Fortunately, Congress has provided several regulatory tools that permit the Forest Service to increase both the pace and scale of urgently needed thinning work. These include the Forest Service's Shared Stewardship Initiative, the Cohesive Fire Strategy, our Governor's Focus 2.0 Initiative, Firewise, our county's cooperative agreement with the Forest Service and the Montana Forest Action Plan.

Although these tools provide both hope and incentive, your strong support is critical. The centerfold of this booklet contains a citizen check-off card we hope you will complete and return to our office. We will share your responses with the Montana Department of Natural Resources, Montana Fish, Wildlife and Parks, the Forest Service and Montana's state and federal elected officials.

This booklet features many QR codes like those you find on packaging in grocery stores. A tutorial on Page 20 explains how to use these codes. Click on them with your cell phone and you will be taken to additional information documenting our wildfire crisis plus information you can use to safeguard your home, family, property and health. A recent EPA report pegs the health hazards associated with wildfire smoke at 12 times greater than the equivalent risk from cigarette smoke. And then there is asbestos and the tragedy of mesothelioma.

Lincoln County is at the most important crossroad since its creation in 1909. Reducing the wildfire risk inside our WUI will bring us new wood processing infrastructure and with it, family-wage jobs that we have not had since 2002. A bright future awaits us. Let's seize it now!

Sincerely,

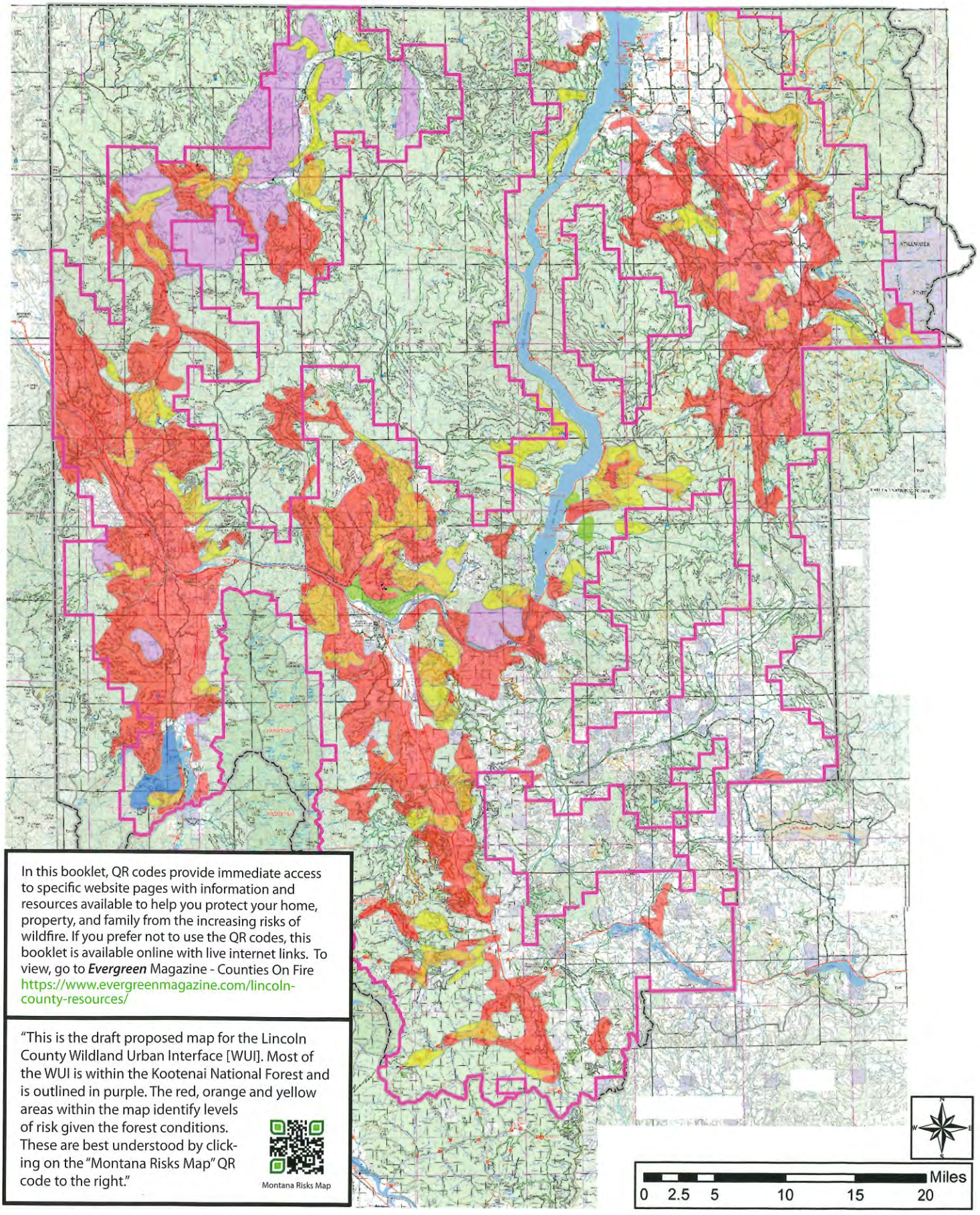
Mark Peck, Lincoln County Commission Chairman

Jerry Bennett, Commissioner

Josh Letcher, Commissioner

You can read this publication online! Go to Evergreen Magazine: https://www.evergreenmagazine.com/lincoln-county-resources/ to open the publication. Click on the QR Codes to follow the links for more information.

Draft Proposed Lincoln County Wildland Urban Interface



In this booklet, QR codes provide immediate access to specific website pages with information and resources available to help you protect your home, property, and family from the increasing risks of wildfire. If you prefer not to use the QR codes, this booklet is available online with live internet links. To view, go to ***Evergreen*** Magazine - Counties On Fire https://www.evergreenmagazine.com/lincoln-county-resources/

"This is the draft proposed map for the Lincoln County Wildland Urban Interface [WUI]. Most of the WUI is within the Kootenai National Forest and is outlined in purple. The red, orange and yellow areas within the map identify levels of risk given the forest conditions. These are best understood by clicking on the "Montana Risks Map" QR code to the right."

Montana Risks Map

Office of the Governor
State of Montana

June 2021

Photo: Bill Langhorne, Western News

Montana Governor Greg Gianforte touring the 90-acre Skidale Good Neighbor Authority project at Libby on May 21.

Montanans know too well how important it is to actively and meaningfully manage our forests. When forests are too heavy with fuels, we experience catastrophic fires that threaten lives and property, destroy wildlife habitat, compromise watersheds, and leave our forests unhealthy.

I'm committed to using all available tools, like the Good Neighbor Authority and collaborative stewardship agreements, to increase active forest management to reduce the risk of catastrophic wildfire, improve forest health, protect homes and communities, and create more good-paying Montana jobs. Completing this work in the Wildland Urban Interface, or WUI, is key.

I appreciate Lincoln County's vision and leadership in developing this proposal. The Department of Natural Resources and Conservation will continue to work actively with the county, the Kootenai National Forest, the National Resource Conservation Service (NRCS), and landowners on projects to improve conditions in the WUI. Our focus includes the interagency update of the County Wildfire Protection Plan, projects on trust lands like Swede Mountain Road, projects on private lands like Pipe Creek, the Joint Chief's proposal, and the Skidale and Clay Day projects.

The state recently completed our Montana Forest Action Plan. The planning process brought together key stakeholders to assess our forest conditions, identify priority areas for treatment, and develop a cross-boundary plan to achieve landscape-scale forest restoration. The findings were alarming: Montana has over 9 million acres at high risk. Our forest action plan recognizes that, because fires, insects, and disease don't stop at fence lines, our management approach can't either. Collaborative work across partners and landowners is critical to reduce fire danger.

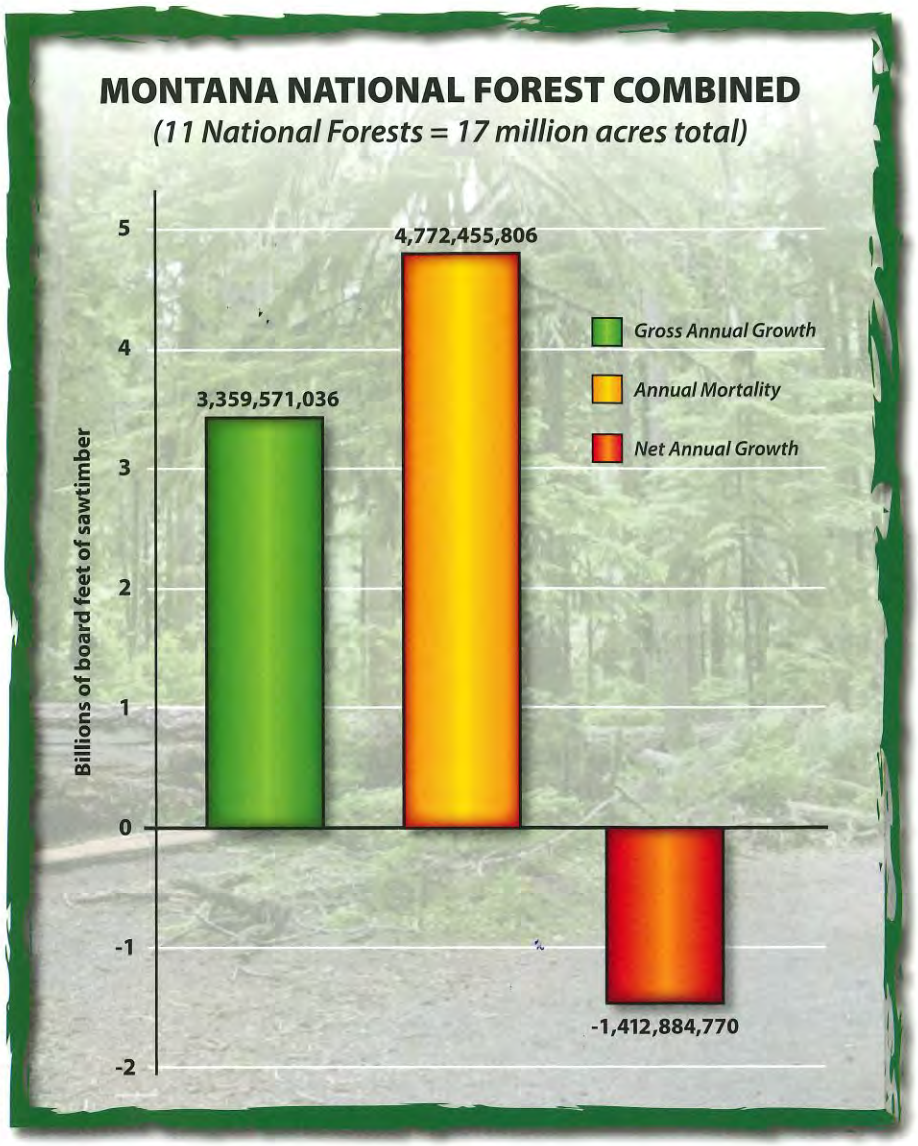
With its framework for shared stewardship, Lincoln County has lifted us from concept to action. This agreement will be a model for other counties looking to do the same within their own priority areas.

We look forward to working with Lincoln County, the Kootenai National Forest, NRCS, and other partners on critical cross-boundary work to expand the pace and scale of forest management and restoration.

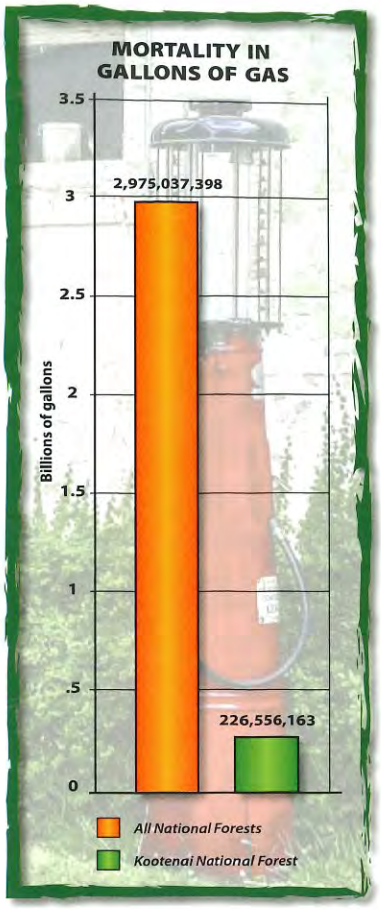
Sincerely,

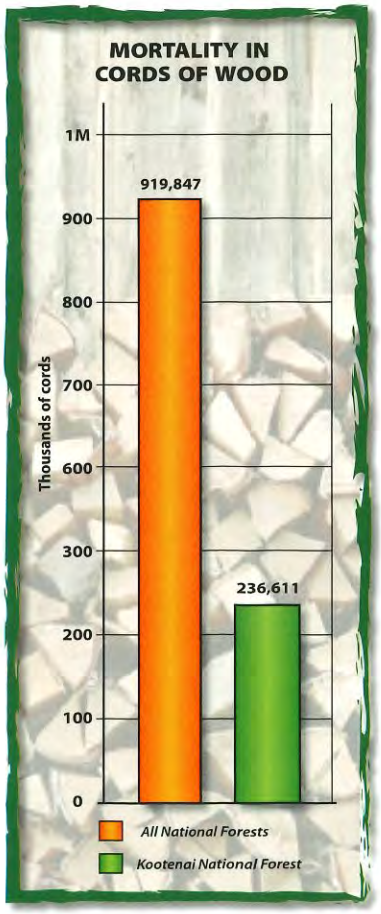
Greg Gianforte
Governor

You can read this publication online! Go to Evergreen Magazine: https://www.evergreenmagazine.com/lincoln-county-resources/ to open the publication. Click on the QR Codes to follow the links for more information.



Charts: E.T. Hinchcliffe





Sustainability – as in sustainably managed forests – is a term that has been with us for many years. It mandates that today's forest management practices do not compromise management options for future generations. This bar graph underscores the fact that we are missing the mark in Montana's 11 national forests. Mortality exceeds growth by a frightening margin.

Annual mortality will continue to outpace growth until the pace and scale of forest restoration work expands significantly. Our two best tools for sustainably managing our national forests are thinning and prescribed fire. We describe their uses on Pages 11–14.

Although Congress seems to recognize our forest health-wildfire crisis, the Forest Service is still billions of dollars short of the funding it needs to increase workforce capacity and increase boots on the ground restoration work.

One nearby QR code on this page leads to a well-footnoted Forest Service workforce capacity study prepared by the National Association of Forest Service Retirees for the Trump and Biden administrations.

A second QR code leads to a detailed "problem-solution" essay written by Forest Service retiree, Michael Rains. Mr. Rains held key management posts in research and administration for 44 years.

The conversion tables used here are based on Kyle's Converter.

1 cubic foot = 12 board feet
1 board foot = 0.62 gallons of gasoline
1,000 board feet = .65 cords. Thus one log truck load [15,000 board feet] = 9.77 cords

Kyle's Converter

BTUs

"Nature" Doesn't Care!

Lincoln County's forests, communities, homes and people are in big trouble. The bar graph on the facing page proves this point.

More than 360 million board feet of timber dies each year. This is very much like stacking firewood around our communities. If you could convert this loss to 1-foot by 1-foot by 1-foot wooden blocks and stack them on any high school football field in our county, the stack would be 1,052 feet tall – four times the height of our nation's capital building! In five years the stack would stretch one mile skyward.

Among the powerful lessons this bar graph teaches is that we can't stop trees from growing. We are adding both new growth and tons of dead trees to our landscape each year. We have two choices when it comes to dealing with this reality:

1. We can let nature manage our forest.
2. We can carefully remove some trees from our forest.

Removing some trees reduces the spread of insect and disease infestations that fuel these fires.

Both choices have consequences. Fortunately, we know how to control the impacts of tree removal, but we have little control over nature, which is why the frequency and intensity of western wildfires in so much greater today than it was 10 years ago.

The hard truth is that nature doesn't care about the things we care about today: clean air, clean water, abundant fish and wildlife habitat, a wealth of year-round recreation opportunity, our homes and family-wage jobs.

Nature doesn't play by our social and cultural rules, so when we neglect our forests – as we are now – we get stand replacing wildfires that incinerate most everything in sight: watersheds, trees, habitat, homes, lives and the organic soil layer in which new seeds germinate.

It is reasonable to ask what our forested landscape would look like if we let nature do the managing. We really don't know because, across Montana, people have been "managing" landscapes for thousands of years using tools they either found or made.

Nature has persisted using its tools: insect and disease infestations, wildfire, windstorms, ice, and floods.

photo: Noah Berger/AP

Chris and Nancy Brown among the remains of their home in Paradise, California.

We've all grown accustomed to the dense forests we see today around our county but this snapshot in time is just that – a snapshot.

Our area has not always been blessed with a carpet of ever-growing trees. In fact, our towns were buried beneath mile-deep glacial ice some 15,000 years ago. We have no idea what forests were here before the ice buildup, but roots buried in frost-covered tundra tell us that redwoods once grew inside the Arctic Circle. Clearly, the climate was much warmer than today and our forests would certainly have been different.

The Native Americans that inhabited our area as the ice receded used fire to clear pathways through forests and to keep trees from encroaching on meadows where they hunted wild game and harvested herbs, forbs and berries – all vital sources of food, clothing and shelter.

Long-term management by Native Americans created the forests that European explorers saw as they pushed west. The diaries of the Kootenai's two earliest white explorers - David Thompson and Finan McDonald – describe a forest landscape marked by the chaos of intermittent fire and populated by fifty to sixty thick barked, fire-resistant trees per acre.

Our 21st century forests look nothing like the 18th century forest. Much of our forest is now holds hundreds – and sometimes thousands – of trees per acre. Far too many for the natural growing capacity of any Montana forest.

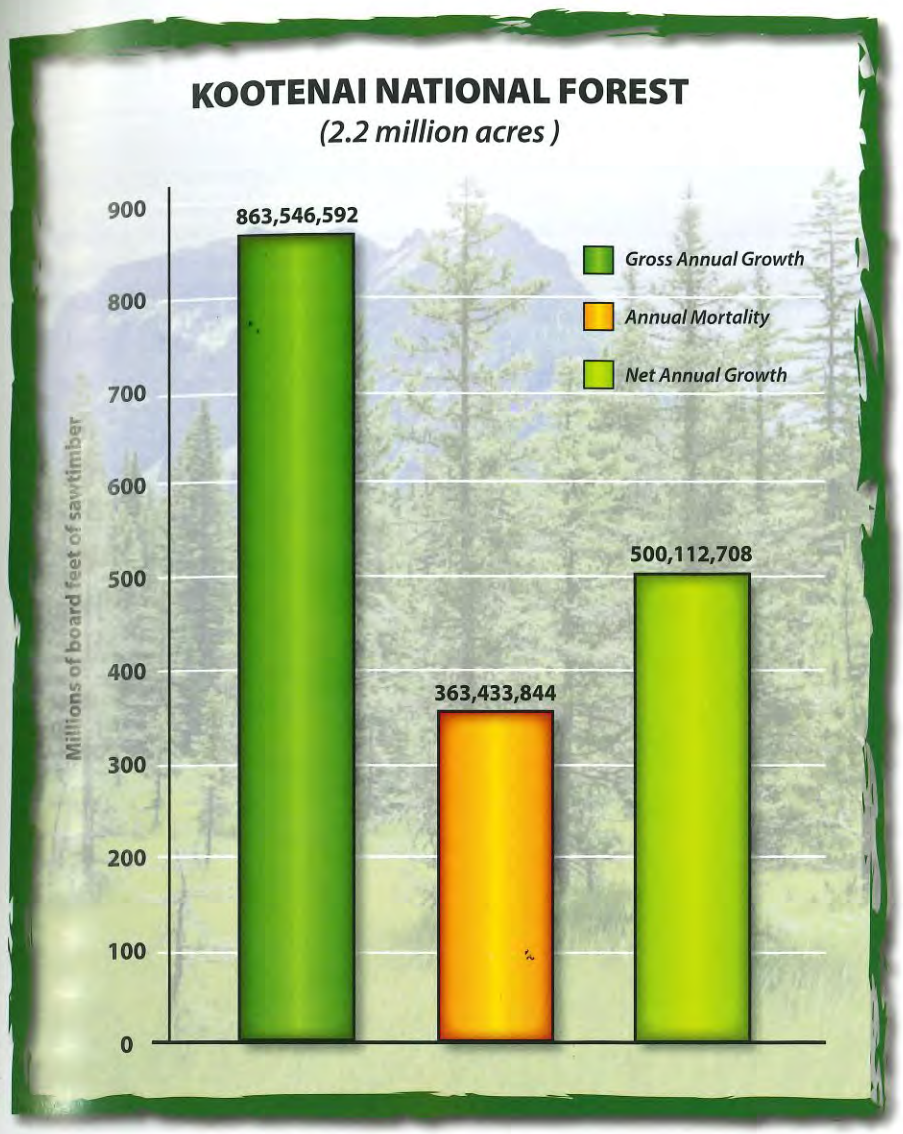
A mature tree can pump up to 200 gallons of water a day, so having too many trees for the available water supply is a problem, especially during prolonged droughts. It's the same with soil nutrients and sunlight. Trees stressed by the presence of too many competitors attract insects and diseases. Dying and dead trees are fueling wildfires that also kill trees that are still alive and growing. This is our current reality in Lincoln County. We must constructively address it now.

Lincoln County, the Kootenai National Forest, the State of Montana and large private timberland owners are proposing we strategically manage the forest to reduce the wildfire risk, enhance forest resiliency and protect our watersheds. The focal point of our management strategy is the Wildland Urban Interface [WUI], a blend of public and privately owned forests that blanket Lincoln County. About 1.1 million WUI acres are in the Kootenai National Forest.

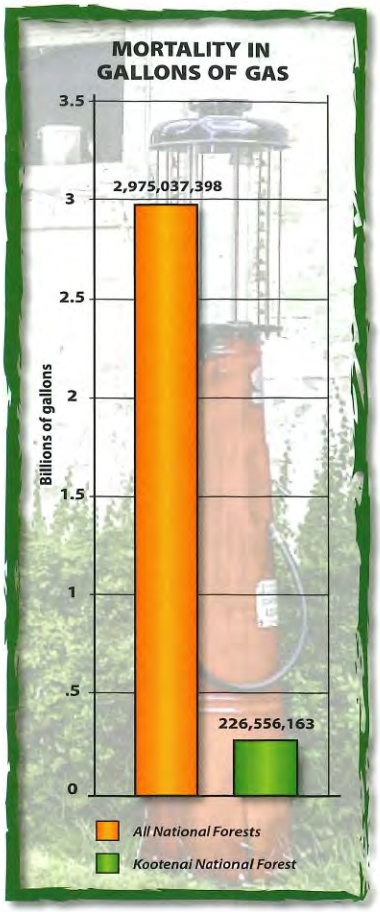
Our two best management tools are [1] thinning in forests that hold too many trees for the natural growing capacity of the land and [2] prescribed fires purposefully lit when there is little danger that these fires will escape. Thinning promotes growth in residual trees and prescribed fire consumes woody debris that collects on the forest floor, including the limbs, stumps and tree tops that thinning generates.

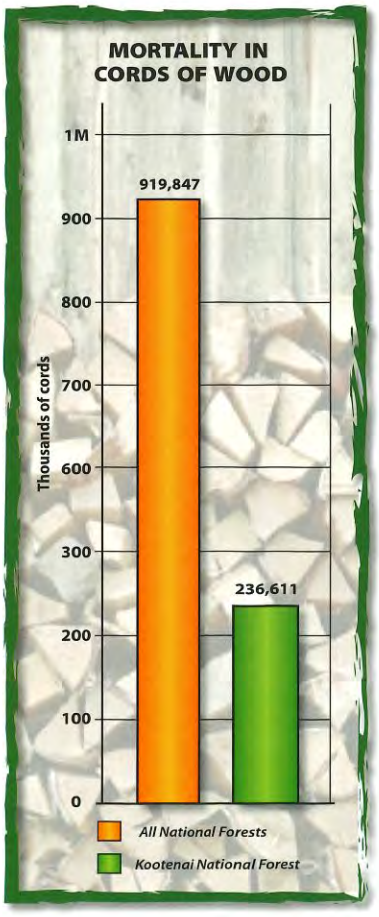
We are excited to embark on a journey that will heed the call-to-action asked for by Libby High School history teacher, Jeff Gruber, in an essay he wrote before he retired. "It is time for us to start a new conversation with government, one that reverses the death throws we are witnessing in our Lincoln County communities. It is our deep desire as citizens of this county, the Kootenai National Forest and the State of Montana to be at the forefront of an optimistic conversation that can foster real and positive change."

Structures Destroyed



Charts: E.T. Hinchcliffe





These bar graphs illustrate and quantify growth and mortality on the Kootenai National Forest. The Kootenai is Montana's most productive national forest – meaning that soils are fertile and trees grow faster than they do on more arid national forests in Montana.

This said, Kootenai tree density and mortality are of great concern to our Lincoln County Commissioners, the U.S. Forest Service, the Montana Department of Natural Resources and our county's private forest landowners, including Stimson Lumber and the Green Diamond Resource Company.

Homeowners living inside our county's Wildland Urban Interface are at increasing risk from catastrophic wildfire. See Pages 18-19 for information you can use to protect your family, property and home.

The QR code on this page leads to a treasure trove of information developed by the Forest Service's Forest Inventory and Analysis program housed at the agency's research stations in Portland, Oregon, Ogden, Utah, St. Paul, Minnesota and Knoxville, Tennessee. The Montana data sets were developed by FIA's Ogden station. Using these QR codes you can actually find your house and judge the wildfire risk facing you and your property. Another nearby QR code leads to a well-footnoted report by the National Forest Service Retirees Association concerning our nation's massive forest management crisis.

You can read this publication online! Go to Evergreen Magazine: https://www.evergreenmagazine.com/lincoln-county-resources/ to open the publication. Click on the QR Codes to follow the links for more information.

Map

We can store carbon in our lungs . . .

In his recent book, First, Put Out the Fire, forestry writer Jim Petersen asks a timely question.

"How many cigarettes are there in a burning tree?"

The answer depends on the size of the tree, but his question wasn't designed to be a math quiz. He asked knowing that most people don't know that wood smoke is deadly – so lethal that the EPA recently estimated that the cancer risk from wood smoke is 12 times greater than from an equal amount of tobacco smoke!

We've all experienced the unpleasant frustration that comes with driving around for weeks on end with our headlights on in broad daylight because the smoke is so thick that other drivers have trouble seeing us.

In July and August of 2019 the air was so thick with smoke that outfitters hosting tourists on the Kootenai River couldn't see across it. These situations are not good for healthy people, let alone those living in our county who have compromised lungs.

The array of QR codes at the bottom of this page lead to several government-sponsored reports that demonstrate that wildfire smoke is harmful because of the long lists of chemicals released that are often the same as those contained in cigarettes.

Some say that summers dominated by huge smoke plumes is "the new normal." There is an element of truth in this statement but it is irresponsible to assume that nothing can be done to manage forest fuels in ways that mitigate the potential harm from smoke.

Certainly, some smoke from wildfires or from prescribed burning is to be expected since we live in a forest that is defined by fire. But the wildfire pandemic we are witnessing across the West is also releasing billions of tons of carbon per year into the atmosphere.

When we breathe wildfire smoke, deadly microscopic particles settle in our lungs, but our plight was ignored by news and health care organizations until putrid smoke descended on large west coast cities. Now we're seeing lots of reports concerning new medical research that identifies the significant health risks linked to wildfire smoke.

Wildfires release millions of tons of carbon dioxide into the air we breathe, but by itself carbon isn't our enemy. In fact, it is a building block of life. Likewise, fire is a natural component of our fire-dependent forests. But the billions of tons of smoke that killing wildfires belch into western skies every year are not healthy for humans or other creatures that live in forests. Better that we store carbon in trees and wood products, not our lungs.

Lincoln County government and our partners plan to proactively address this crisis with our plan for managing dense forests in the WUI that surrounds our homes and communities. For many of us who live here, wildfire and its deadly smoke have become "environmental justice" issues. Reducing the amount of smoke we breathe by first reducing the risk of wildfire rights a wrong not of our doing that Lincoln County residents have lived with for too long.

Wildfire Emissions

Stanford Wildfire Research

Stanford Health Impacts

Smoke Composition

Air Quality

You can read this publication online! Go to Evergreen Magazine: https://www.evergreenmagazine.com/lincoln-county-resources/ to open the publication. Click on the QR Codes to follow the links for more information.

. . . or we can store carbon in our forests!

Before white settlement began, Lincoln County's forests were a source of food, clothing and shelter for Native Americans. European explorers and settlers relied on Kootenai forests for the same essentials.

Today, we expect even more from our forests. Spring, summer, fall and winter, we value their timeless beauty. They are as much our home as the house we live in. This is a why the forest stewardship discussion is so important to all of us: old-timers and newcomers alike.

Here at home and around the world, people are also developing an appreciation for yet another forest quality: the miraculous ability of healthy forests to store or sequester carbon while simultaneously releasing oxygen into the air we breathe.

Our oceans hold more of earth's carbon than any other source, but carbon is also stored in rocks, soil, plants and trees. For decades global political leaders have been discussing a variety of climate change initiatives that revolve around sequestering carbon and other harmful greenhouse gases that otherwise escape into our atmosphere.

Photosynthesis is the process by which trees and other green plants store carbon by converting light energy into chemical energy. Light energy – the sun or grow lights – drives the conversion of water, carbon dioxide and minerals into oxygen and organic compounds, including cellulose that forms the walls in all plants. Cellulose is the basic ingredient in wood.

Trees are literally tubes of sequestered carbon. They grow upward and outward in layers using the same cell division process that drives all living organisms. The outer layers of trees are living tissue. Most of the trunk is dead tissue – wood that supports the increasing height and weight of growing trees.

Trees store about 25 percent of atmospheric carbon. The rate of carbon uptake varies widely with species, age, soil quality, elevation, aspect, heat, cold, sunlight and rainfall. Older, larger trees store lots of carbon in their wood but younger trees produce and store carbon at a much faster rate. As trees age, the rate at which they store new carbon slows and eventually stops.

Tree mortality on the Kootenai National Forest is increasing, so the carbon sequestration discussion is very important. We must strike a better balance between new growth, slowing growth and harvest. We must carefully remove as many diseased trees as possible before they burn – before they release the last of their stored carbon into the air we breathe.

With forest stewardship goals shared by all of our partners – the Forest Service, our state and our private forest landowners – we can sequester lots of carbon. To see what this process looks like on the ground, study the two photographs on the next page. They were taken from Pipe Creek Road near its intersection with Sheldon Mountain Road just north of Libby.

The top photo shows thinning in the foreground and a dense thicket behind it. There are countless "dog-hair" forests like this one within the Lincoln County Wildland Urban Interface.

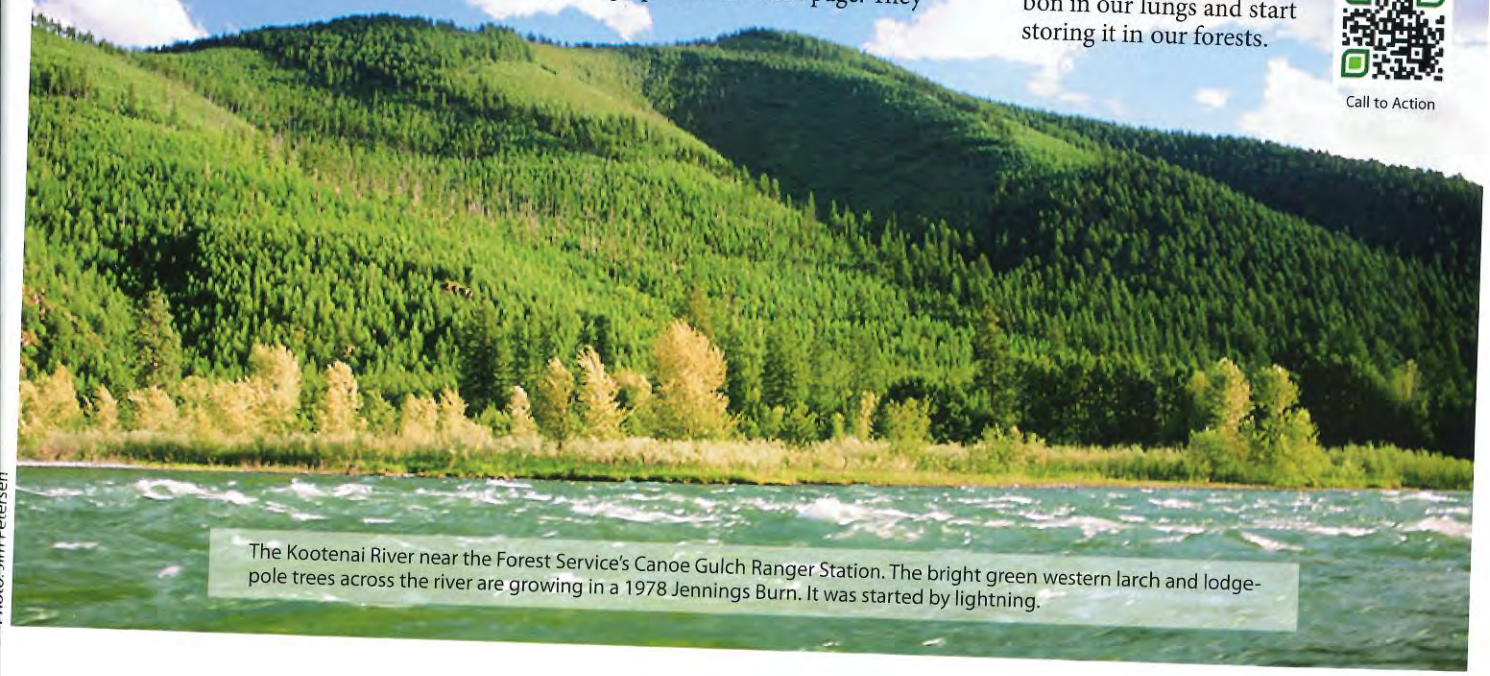
The bottom photo was also taken from Sheldon Mountain Road. This is what most of the Lincoln County WUI should look like – carbon sequestration at work in a well-managed forest. This site burned in the early 1900's and has been repeatedly thinned by the Forest Service for more than 100 years.

The work we envision won't take wildfires out of our forests. Nor should it. But it will reduce their size, frequency and killing force. It will also bring our communities new wood processing technologies capable of transforming the smallest trees into useful products. More on this in "Back to the Future" beginning on Page 15.

The environmental and economic benefits are many, but the ones that come immediately to our minds are clean air, clean water, abundant fish and wildlife habitat, a wealth of year-round outdoor recreation opportunity and family-wage jobs that are a by-product of our shared stewardship work.

We can do this in Lincoln County. Failure is not an option. We must stop storing carbon in our lungs and start storing it in our forests.

Call to Action



The Kootenai River near the Forest Service's Canoe Gulch Ranger Station. The bright green western larch and lodgepole trees across the river are growing in a 1978 Jennings Burn. It was started by lightning.

Photo: Jim Petersen

Our best tools: Thinning and prescribed fire

The best tools we have for reducing wildfire risk are [1] thinning in forests that hold too many trees for the growing capacity of the land and [2] prescribed fire to clean up forest floor woody debris and keep fires from climbing into treetops and creating forest-killing crown fires.

These tools are often used to meet the mission statements for the major landowners in our county. Mission statements reflect the owners desire to manage lands to maintain for overall forest health, including managing to minimize the dangers that come with wildfire.

The Forest Service's mission is, "To sustain the health, diversity and productivity of the nation's forests and grasslands to meet the needs of present and future generations."

The mission statement of the Montana Department of Natural Resources and Conservation [DNRC] is "To ensure the sustainability of Montana forests, rural lands and communities through cooperative wildland fire protection, sound forest management practices and by promoting a viable forest-based economy." DNRC has an office in Libby and manages 50,000 acres of trust land in its Libby Unit. Timber harvested from trust lands helps fund Montana schools.

Stimson Lumber Company owns about 130,000 acres within the Kootenai National Forest – much of it within the Wildland Urban Interface. Stimson's mission statement tells us they are, "Committed to growing trees and operating mills in a sustainable manner to create value for Stimson and the communities in which we operate."

Green Diamond Resource Company recently bought 291,000 acres of forestland that has a storied history of management by Weyerhaeuser, Plum Creek Timber, Champion International, St. Regis and J. Neils Lumber Company. Some of these forested acres are in the Wildland Urban Interface. Green Diamond tells us its mission is, "To improve all aspects of the world in which we operate across a triple bottom line: People, Planet and Profit."

If you own a parcel of forested lands, whether it is 2 acres or 200 acres, it would be wise to develop a forest management plan for your ownership. Your plan would probably be similar to the other, larger landowners and speak to your desire to have your land and forests meet the needs of yourself and future generations.

The FireSafe program outlined and illustrated on Pages 18 and 19 of this booklet lists numerous professional resources that are available to help you define and implement your forest mission.

While some of the forest owners of our area been able to achieve their vision, many have not and the lack of management on hundreds of thousands of acres near our homes has generated a crisis that our Shared Stewardship proposal intends to address.

This Stimson Lumber Company thinning on east side of the Bull River Highway backs up to U.S. Forest Service land and the Cabinet Mountains. A similar thinning is planned for the west side of the highway.

Photo: Julia Petersen

National Interagency Fire Center

Good Neighbor Authority

DNRC Facts

Lincoln County is, tragically, not alone. The U.S. Forest Service, our county's largest landowner, estimates that between 80 and 90 million acres in western national forests are in Condition Class 3 or 2 – meaning it is ready to burn or soon will be. Here is a QR code that leads to a map that illustrates and pinpoints wildfire risk in Montana national forests, including the Kootenai. A short tutorial on the use of QR Codes appears on the back page of this pamphlet and we urge you to learn how to use them.

This data – including satellite imagery - was collected by the agency's Forest Inventory and Analysis [FIA] staff in Ogden, Utah. It is frightening. Once you have mastered QR codes and FIA's website, you will be able to find your own home on FIA's website. If you live within the designated Wildland Urban Interface, your home and family could be in danger.

The solution to this ongoing problem – large-scale, long-term thinning projects that lower the wildfire risk – is what Lincoln County is proposing.

Good examples of what needs to be done can be found on some private lands, some lands cared for by the Montana Department of Natural Resources, and on some Forest Service lands. Their work in the landscape throughout our county improves wildlife habitat, protects our watersheds and improves the ability of our forests to withstand disease, drought and wildfire.

Part of the solution to our forest health issue will also require localized processing facilities that can economically receive the material removed from managed lands. These facilities will not be copies of the mills of the past but may ultimately provide career opportunities for future generations of Lincoln County children and families.

Andrew Miller, President and Chief Executive Officer, Stimson Lumber Company

"Stimson Lumber Company is highly supportive of Lincoln County's plan to provide additional resources that address the mounting wildfire risks in the Wildland Urban Interface in Lincoln County.

Stimson has committed resources to this effort because it is the right thing to do for the landscape, private property owners, public resources and the citizens of Lincoln County.

Absent a concerted effort to increase the pace and scale of forest treatments that remove fuels from the forest and make lands more resilient, wildfire risks will continue to increase at an alarming rate.

Stimson supports the county's initiative and resolves to keep Lincoln County a special place to live and work."

Andrew Miller,
President and CEO
Stimson Lumber Company

Thinning trees from overstocked forests can be messy. It may cause you and your neighbors to wonder if you have done the right thing for your forest. Prescribed burning blackens the mess and fills the air with smoke.

It's all temporary. Your forest will "green up" the following spring. Wildflowers you didn't know you had will bloom again and the trees you kept in your forest will begin to grow larger.

Remember that a big part of your mission is to avoid catastrophe – the loss of your home and all your trees in a much larger wildfire you cannot control.

The forests around us will not stay "pretty" if we do nothing. The pictures on these pages show that the failure to manage forested lands can yield an ugly outcome. That tough lesson has been learned in dozens of small and large communities across the West.

We do not need to relearn the lesson here – and we do not want a repeat of the Great 1910 Fire. Three million acres were lost across northern Idaho and western Montana – much of it in a 48-hour firestorm that leveled several small towns.

Lincoln County was not spared. We cannot stop trees from growing, but we can control our future by carefully managing forest growth in ways that reduce the risks posed by insects, diseases and unnaturally large and destructive wildfire.

Much like painting the Golden Gate Bridge, the "job" is never done. Paint fades in the sun and trees grow in it, so you keep painting and you keep thinning. The only thing we can think of that could break this cycle is a return of the mile-deep icefield that once blanketed Lincoln County.

You can read this publication online! Go to Evergreen Magazine: https://www.evergreenmagazine.com/lincoln-county-resources/ to open the publication. Click on the QR Codes to follow the links for more information.

BACK TO THE FUTURE!

Change is the only constant in Lincoln County's forests and communities.

Change can be challenging, but we sense great opportunity – a marvelous future for all of us.

Our roadmap to the future is embedded in our Shared Stewardship proposal for managing forests within our Wildland Urban Interface. Lincoln County must lead this effort.

We have solid backing from our major private timberland owners, Montana DNR, Montana Fish, Wildlife and Parks and Governor Gianforte. Congress has provided the administrative tools we need to move forward and the Forest Service has signaled its willingness to do its part. This is key because about one million acres of our Wildland Urban Interface lies within the Kootenai National Forest.

For more than 100 years, Libby, Troy, Eureka, Rexford and Trego were thriving communities. As late as the mid-1980's Lincoln County led the state in per-capita income. Very few truly wealthy people lived here but family-wage, blue-collar jobs were abundant because we were home to a thriving timber industry. Forest growth on the Kootenai National Forest exceeded harvest and tree mortality by a wide margin.

Growth still exceeds mortality on the Kootenai but the gap is narrowing at a frightening rate because we aren't caring for our forest as we did for more than a century. Our communities are in no better shape. Lincoln County now ranks 43rd in per capita income in Montana. Storefronts are boarded up and family-wage jobs are so scarce that most of our high school graduates – our future – are forced to leave to find work.

In our struggle to reinvent ourselves, we have overlooked our greatest opportunity. It's the forest that fed and clothed us and educated our children for more than 100 years. The forest that brought us hope and prosperity. The forest that needs us now in the same way we need it.

The forest restoration plan envisioned in our Shared Stewardship proposal will not fix all of our economic problems, but it can provide a diverse foundation of sustainable hope, growth and opportunity for our families and businesses.

Careful management of the Wildland Urban Interface will reduce wildfire risk and improve forest resiliency. Small diameter trees and woody biomass are byproducts of this process. If history is our guide, the fiber we remove from our Wildland Urban Interface will be processed in Lincoln County because it's the most efficient way to do it.

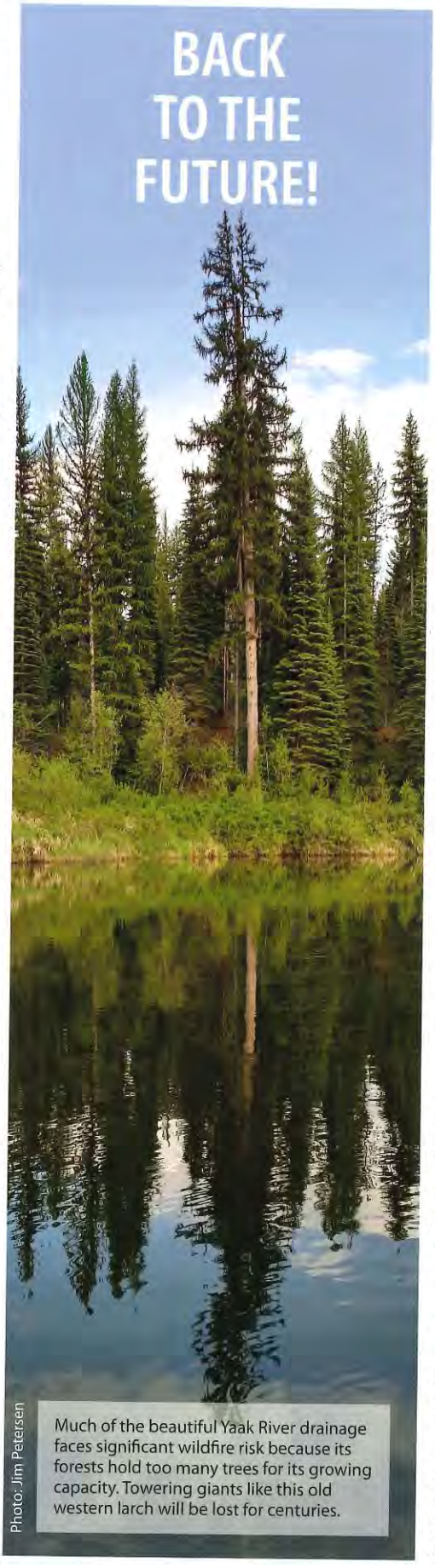


Photo: Jim Petersen

Much of the beautiful Yaak River drainage faces significant wildfire risk because its forests hold too many trees for its growing capacity. Towering giants like this old western larch will be lost for centuries.

There is also a wood-fired powerplant somewhere out there in our future. We need one because the Kootenai holds millions of tons of woody biomass too small to be made into lumber. Air pollution technologies will soon be capable of removing even microscopic particles from the steam the facility generates..

We have no way of knowing how many family-wage jobs can be created over the next decade. Much depends on our ability to attract new investments in wood processing. But this much is certain: Every economic sector in our county will benefit.

None of this will happen overnight and our future won't look like the past. New technologies make it possible for us to manufacture value-added wood products that did not exist a decade ago. Nanotechnologies will soon allow us to reconstruct wood fibers that can now only be seen under powerful microscopes.

We are working hard with our partners to match investment capital with the wood fiber supply that can be removed from our Wildland Urban Interface in perpetuity. There is no other way to reduce the insect/disease/wildfire risk we face to safe levels – and hold it there.

With the rising acceptance of remote working and with the pandemic and cultural unrest, many Americans want to move from their urban realities to more peaceful rural environs. Montana and Lincoln County look like miracles to these families.

Some of our new neighbors are already here and many more are coming. With them come new ideas, new money and new energy. These are the ingredients that built Lincoln County, so we think it is vital that we warmly embrace them. Much like the old Welcome Wagon days, we should thank them for choosing the wonderful area we love and work to help them become a part of our culture.

Our new neighbors will most likely buy homes or property in our Wildland Urban Interface. But it's unlikely that they've ever heard the term "WUI." They won't know that their new home, property and businesses face the same increasing wildfire risks we've faced for 30 years. It's our job to share our knowledge with them and to assure them that

we can all live safely within the "WUI" by doing a much better job of caring for our forests.

The graphs, photographs and QR codes in this booklet tell two stories. One reflects the reality of the grave danger and challenges we and our forest landscapes face. The other reflects our hopes for a healthy and vibrant future for our forests and communities.

Former Lincoln County Commissioner, Mark Peck, will lead the charge from his new post with the Lincoln County Port Authority. He will be the county's liaison with state and federal forest management agencies. His new post has been funded by the Stimson Lumber Company. He is already working with investors who have expressed interest in developing new wood processing facilities in our county.

Mark is a Libby native and knows our county very well, but he will need our help and support in his work with the Montana Department of Natural Resources, the Kootenai National Forest staff and the Forest Service's Region 1 office in Missoula.

A bright future awaits us, but we need to roll up our sleeves and get to work. Start now by making sure your family and home are safe in the event a wildfire approaches your property. The next two pages list professional resources that are available locally to help you develop your own fire protection plan.

Don't forget to return the envelope in the center of this booklet.

Thanks for doing your part!

Photo: Jim Petersen

Photo: Eli Shotola

Top photo: Dave Ehrmantrout's forwarder, "Turtle," winds its way through a Forest Service thinning project near Bonners Ferry, Idaho. **Bottom photo:** Sophie Petersen with her first fish caught on a fly rod. That's Kootenai Angler guide, Dave Blackburn, holding her fish.

Photo: Julia Petersen

Photo: Julia Petersen

Top photo: A Montana Department of Natural Resources thinning on Swede Mountain east of Libby reduces the risk of stand replacing wildfire, protecting water quality, habitat and nearby homes. **Bottom photo:** An adjacent Forest Service thicket that – if thinned – would look more like the top photo.

Appendix E. Pledges of Support

PLEDGE OF PROJECT SUPPORT

Project Name: Lincoln County Biomass Waste-to-Energy Project

Applicant / Sponsoring Entity: Lincoln County, Montana

Project Location: Lincoln County, Montana

I, the undersigned, hereby affirm my organization's support for the Lincoln County Biomass Waste-to-Energy Project, which proposes converting excess woody biomass and other eligible waste materials into a beneficial energy resource.

This project addresses a critical local and regional need by reducing hazardous woody biomass, improving forest and watershed health, diverting material from disposal, and generating renewable energy. It provides measurable public, environmental, and economic benefits to Lincoln County and surrounding communities.

On behalf of my organization, I acknowledge that the Lincoln County Biomass Waste-to-Energy Project is consistent with our mission and supports Montana's goals related to renewable resource conservation, responsible waste management, and resilient infrastructure. If funding is awarded through various private, state, or federal entities, my organization supports the successful development and implementation of this project and recognizes its value as a long-term community asset.

As applicable, my organization is prepared to collaborate with Lincoln County through coordination, technical input, or other forms of participation (i.e. feedstock delivery) to advance the project and help ensure its successful completion. *This pledge does not constitute a binding commitment to deliver feedstock, enter into a contract, or incur financial or operational obligations.*

This pledge of support may be included as part of Lincoln County's various funding applications, request for proposals/information (RFPs/RFIs), and marketing materials.

Authorized Representative

Printed Name & Title: DOUG YEAGER

Company / Organization: TOUGH-GO-LOGGING

Signature: Doug Yeager

Date: 4/22/2026

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Authorized Representative

Printed Name & Title: Pat Stoken

Company / Organization: Stoken Logging

Signature: Pat S

Date: 4-22-26

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Authorized Representative

Printed Name & Title: Brian McCully

Company / Organization: McCully Wood

Signature: Brian McCully

Date: 4-22-26

Appendix F. Bioeconomy Development Opportunity Zone Rating

Bioeconomy Development Opportunity Zone Rating

'A'

The Libby, Montana BDO Zone is rated 'A'. Long-term outlook on feedstock availability, cost, and quantity of Forest Residuals and Pulpwood is deemed stable. Limited access to Sawmill Residuals at market prices.

Rating Parameters

Feedstock quantity	Feedstock Type	Feedstock Price	BDO Zone
225,000–275,000 gt/year	**Forest Residuals**	**$30–35 /gt**	**80-mile drive distance from Libby, MT**
	Pulpwood	**$25–35 /gt**	
	Sawmill Residuals	**$15–55 /gt**	

BDO Zone Assets

- **225,000–275,000 green tons per year (gt/yr) of woody biomass available to new plant development.**
- **Few competing markets for Forest Residuals and Pulpwood.**
- **Reliable anchor supply.**
- **Available forest products labor market.**

BDO Zone Liabilities

- **Strong demand for Sawmill Residuals from existing markets. Limited and competitive access is likely for new markets.**
- **Strong likelihood of material supply chain impacts from externalities: slow lumber markets, periodic wildfires, and extreme weather events.**
- **Significant feedstock derived from National Forest Service land and subject to associated risks.**
- **Increasing fuel prices stress logging and transportation costs.**
- **Fiber from federal lands does not qualify for Low Carbon Fuel Standard (LCFS), which is a limiting factor on commercial development.**

BDO Zone Rating Objective

This Bioeconomy Development Opportunity (BDO) Zone Rating offers critical insights into the biomass supply chain and infrastructure risk essential to translating biomass feedstock complexity into clarity so market participants can uncover opportunities and expedite decision-making on new plant development.

Risk Rating Grade

The Libby, Montana BDO Zone is rated 'A', or *low risk*.

BDO Zone Risk Rating Grades are defined as follows: Aa (*very low*), A (*low*), Baa (*low-moderate*), Ba (*moderate*), B (*moderate-high*), or C (*high*).

In assessing biomass supply chain risk for the Libby BDO Zone, 51 Risk Indicators from the *US Biomass Supply Chain Risk Standards* (BSCR) were applied. These Libby BDO Zone Risk Indicators are the subset of BSCR Risk Indicators applicable to gauging feedstock risk within a BDO Zone.

Feedstock quantity is expressed in green tons (gt). Feedstock cost is expressed in US dollars, FOB Destination, delivered to Libby, Montana, with a maximum transport distance of 80 miles.

Scoring and Rating Methodology

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 Risk Indicator is given a **Raw RI** Score based on the research and analysis conducted on the feedstock supply chain in the region. Raw RI Scores are scaled between 1 (*low risk*) and 10 (*high risk*).

Next, each Risk Indicator is discounted, or "notched", based on the degree to which the uncertainty drivers are deemed to be addressable, and whether there is a reasonable expectation that mitigation measures could be put into place within the price parameters for this rating. The **Notched Salience score** represents this and corresponds to the likelihood of each Risk Indicator's described risk materializing given the implementation of reasonable mitigation measures by a new bio-

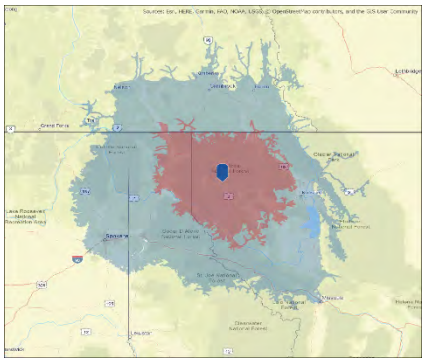
based plant. To arrive at the Notched Salience score, Raw RI Scores are reduced based on the efficacy of the proposed mitigation measures. If applicable, notching occurs at one of 3 levels: 25%, 50%, or 75%.

Finally, the potential impact of each Risk Indicator on the supply chain is assessed and scored on a 10-point **Impact Level** scale, as either *low (3.33), moderate (6.66),* or *high (9.99).* Impact Level scores reflect the impact on the project from that Risk Indicator should we be unsuccessful in mitigation efforts.

The **Loaded RI** score for each Risk Indicator is then calculated as the product of Notched Salience and Impact Level scores. For example, if the Raw RI Score for the Risk Indicator *Feedstock Supply Curve* is scored at 4, notched by 25%, and the Impact Level is deemed "low" (i.e., 3.33), then the final Loaded RI is (Raw RI 4 × 1/.25 notch) 3 Notched Salience × 3.33 Impact = 9.99 (out of 100).

Loaded RI scores of 33.33 or less are deemed ***low risk***; scores greater than 33.33 and less than 66.66 are deemed a ***moderate risk***, and scores of 66.66 to 100 are deemed ***high risk***.

Libby, Montana BDO Zone



The total risk rating for the BDO Zone is the average of all Loaded RI scores. The BDO Zone score for Libby, Montana, is **15.18 *out of 100, resulting in an 'A' designation.*** All scoring and rationale for each Risk Indicator are provided in Appendix A.

Analyst Notes

We estimate the annual generation of woody biomass in the BDO Zone at 790,392 gt/yr[1], comprised approximately as follows: 450,819 gt/yr of Sawmill Residuals, 273,088 gt/yr of Forest Residuals, and 66,485 gt/yr of Pulpwood[2].

Of this total, we estimate approximately 256,479 gt/yr to be functionally available for new bio-plant development. However, we believe that only Forest Residuals and Pulpwood can function as strong levers for new market development.

We note that market demand for Forest Residuals is low: the bulk of potentially available Forest Residuals are currently not utilized by competitors in the BDO Zone. The majority are either left in the forest after harvest or burned on site. We assume a capture ratio of 55% and estimate that approximately 150,198 gt/yr of Forest Residuals are likely available to new bio-based markets in the Libby BDO Zone.

Demand for Pulpwood saw a dramatic decrease in the Libby BDO Zone with the closure of a prominent pulp mill. Without a high level of market demand, harvesting of Pulpwood is being conducted at greatly reduced levels versus previous decades. Pulpwood removal is an important component of forest management: foresters and land managers in the Libby BDO Zone will likely support the development of new market outlets for Pulpwood to aid silvicultural and fuels reduction objectives[3]. At present, removals occur primarily during pre-commercial and commercial thinning or when written into logging specifications on a job-by-job basis (i.e., when a logging contract stipulates that Pulpwood must be removed).

[1] Forest Inventory and Analysis (FIA) estimates provided by the University of Montana-Bureau of Business and Economic Research. May 2022.

[2] We define Pulpwood in this report as trees 5–11 inches in diameter at breast height (dbh).

[3] Verbal communication with foresters, land managers, and loggers in the Libby Supply Basin. April–May 2022.

Assuming 66,485.58 gt/yr of Pulpwood in the Libby BDO Zone, we apply a reasonable capture ratio of 25% to derive an estimate of 16,621.39 gt/yr of Pulpwood to a new bio-based project in the Zone.

For the purpose of this rating, we see large quantities of Sawmill Residuals as functionally unavailable for new plant development. Currently, Libby BDO Zone sawmills commit nearly all Residuals to existing markets located in the Competition Zone[4] or use them internally for kiln drying and facility heating. Estimates for Sawmill Residuals were generated using Forest Inventory and Analysis (FIA) and Timber Product Output data examined by the University of Montana-Bureau of Business and Economic Research in May of 2022. We assume a capture rate of 10% to 20% for Sawmill Residuals based on the fact that we are unable to estimate the ability of current markets to drive price and on reduced haul distances of a new plant versus existing markets. On that basis, we find it reasonable that ~67,623 gt/yr could be available at market prices. We estimate the ranges for current delivered prices in US dollars per green ton as follows:

Forest Residuals: $30 to $35

Pulpwood: $25 to $35

Sawmill Residuals (by category):

- Bark: $25 to $30
- Sawdust: $15 to $20
- Shavings: $32 to $37.50
- Softwood Chip: $50 to $55

The forestry industry in the Libby BDO Zone is strong, with a long history of production and performance. We note a reduction in small sawmills over the last few decades to fewer but higher volume primary wood processors. Currently, the woody biomass supply chain in the Libby BDO Zone is anchored by several key operating feedstock generators: 8 sawmills and at least 20 fiber producers/harvesters[5]. The forestry labor market is capable of scaling to support new plant development over time; we do not anticipate labor or skill shortages.

Salient Risk Indicators

Both suppliers and supply chains in the Libby BDO Zone are subject to material macroeconomic, environmental, and political external risk factors—the lumber market, fire, forest pests, disease Low Carbon Feul Standard (LCFS) credit values for fiber.

Significant quantities of feedstock are derived from National Forest Service land and we see material supply uncertainty over time linked to this. In particular, we note the fact that under current regulatory regimes fiber from federal land does not qualify for LCFS credit. We see this as a significant limiting factor for commercialization of the Zone as it limits the types of biofuels that can be produced in it.

Competitor location and geographical influence on the market pose a moderate risk to all categories of feedstock—with the exception of Sawmill Residuals, where we find material risk.

Thirty-three competitors for Sawmill Residuals were identified within a 160-mile drive distance from Libby: medium-density fiberboard (mills, pellet mills, and wood fuel for facility heating all consume Sawmill Residuals in significant quantities[6]. Since the ability of current markets to drive price is unknown, we find material risk around the supply of Sawmill Residuals for new bio-based markets in the Zone and significantly discount this category of biomass from the quantity in this rating.

[4] Defined by a 160-mile drive distance from the Libby BDO Zone center point.

[5] See Tables C and D in this report for names, addresses, and contact information.

[6] While exact values for biomass consumption by markets is not publicly available, feedback for this rating suggests that they currently account for nearly 99% of Sawmill Residual intake.

Infrastructure Asset Profile

Libby's infrastructure assets were scored on a scale of 0–10, with scores defined as follows: 0 (*very good*), 2 (*good*), 4 (*reasonable*), 6 (*fair*), 8 (*poor*), 10 (*insufficient*). Among the top-rated assets are landfill access, a sewage disposal trunk line, outdoor recreational activities, highway access, and land cost.

Overall, Libby, Montana has a profile of positively rated infrastructure assets, with an average score of **3 out of 10**. This score supplements the Libby BDO Zone rating and supports its *low risk* designation. The full infrastructure asset profile is detailed in Table 2. Documentation supporting infrastructure assessment is available upon request.

Contact Info:
Jordan Solomon
President & CEO
Ecostrat Inc.
jordan.solomon@ecostrat.com

Figure 1 - Risk Indicators (Sorted by Risk Level)

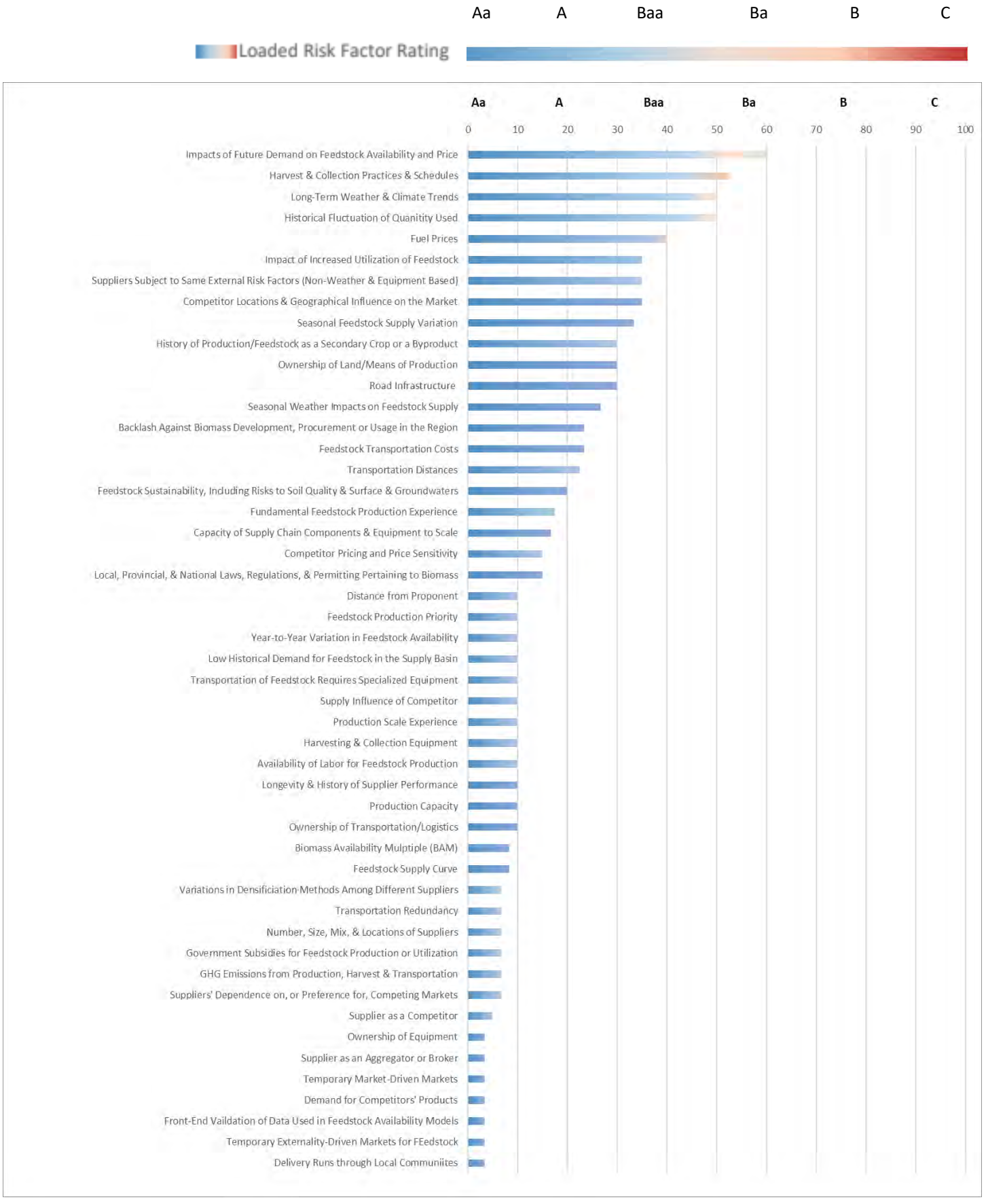


Table 1: Risk Indicators

Feedstock Supply Chain Risk Indicators	Raw RI Score	Notched Salience	Impact Level	Loaded RI Score
Category 1: Supplier Risk				
Longevity & History of Supplier Performance	1	1	6.66	6.66
Production Capacity	1	1	6.66	6.66
Supplier's Dependence on, or Preference for, Competing Markets	1	1	3.33	3.33
Supplier as a Competitor	1	1	3.33	3.33
Ownership of Land/Means of Production	4	4	6.66	26.64
Ownership of Equipment	1	1	3.33	3.33
Ownership of Transportation/Logistics	1	1	6.66	6.66
Supplier as an Aggregator or Broker	1	1	3.33	3.33
Distance from Proponent	3	3	3.33	9.99
Fundamental Feedstock Production Experience	5	2.5	6.66	16.65
Production Scale Experience	3	2.25	3.33	7.49
Feedstock Production Priority	2	1.5	6.66	9.99
Category 2: Competitor Risk				
Competitor Locations & Geographical Influence on the Market	4	3	9.99	29.97
Historical Fluctuation of Quantity Used	5	3.75	9.99	37.46
Competitor Pricing & Price Sensitivity	4	2	6.66	13.32
Impacts of Future Demand on Feedstock Availability & Price	8	6	9.99	59.94
Supply Influence of Competitor	5	1.25	6.66	8.32
Temporary Market-Driven Markets	1	1	3.33	3.33
Demand for Competitors' Products	1	1	3.33	3.33
Category 3: Supply Chain Risk				
Biomass Availability Multiple (BAM)	2	2	3.33	6.66
Impact of Increased Utilization of Feedstock	5	5	6.66	33.3
Feedstock Supply Curve	2	2	3.33	6.66
Seasonal Feedstock Supply Variation	6	4.5	6.66	29.97
Year-to-Year Variation in Feedstock Availability	1	1	9.99	9.99
Front-End Validation of Data Used in Feedstock Availability Models	1	1	3.33	3.33
Low Historical Demand for Feedstock in the BDO Zone	3	3	3.33	9.99
History of Production/Feedstock is a Secondary Crop or a By-product	3	3	9.99	29.97
Diesel Prices	7	5.25	6.66	34.96
Harvest & Collection Practices & Schedules	6	6	6.66	39.96
Harvesting & Collection Equipment	3	2.25	3.33	7.49
Temporary Externality-Driven Markets for Feedstock	1	1	3.33	3.33
Variation in Densification Methods Among Different Suppliers	2	2	3.33	6.66
Availability of Labor for Feedstock Production	3	2.25	3.33	7.49
Feedstock Transportation Costs	3	3	6.66	19.98
Transportation Distances	6	6	3.33	19.98
Transportation of Feedstock Requires Specialized Equipment	2	1.5	6.66	9.99
Delivery Routes through Local Communities	1	1	3.33	3.33
Transportation Regulations & Local Weight Limits	1	1	3.33	3.33
Road Infrastructure	4	4	6.66	26.64
Transportation Redundancy	2	1	6.66	6.66
Number, Size, Mix, & Locations of Suppliers	2	2	3.33	6.66
Suppliers Subject to Same External Risk Factors (Non-Weather & Equipment Based)	5	5	6.66	33.3
Seasonal Weather Impacts on Feedstock Supply	5	2.5	9.99	24.97
Long-Term Weather & Climate Trends	6	6	6.66	39.96
Government Subsidies for Feedstock Production or Utilization	2	2	3.33	6.66
Local, Provincial, & National Laws, Regulations, & Permitting About Biomass	4	4	3.33	13.32
Backlash Against Biomass Development, Procurement, or Usage in the Region	5	2.5	9.99	24.97
Feedstock Sustainability, Including Risks to Soil Quality, & Surface & Groundwaters	3	3	6.66	19.98
GHG Emissions from Production, Harvest & Transport	2	2	3.33	6.66
Geographic Location Influence on Feedstock Variability	1	1	3.33	3.33
The capacity of Supply Chain Components & Equipment to Scale	6	1.5	9.99	14.98
				15.18

Table 2: Asset Indicators

Infrastructure Assets	Overview	Score
Category 1: Physical Infrastructure		
1.1 Land Parcel	75% of Lincoln County is in public ownership.	2
1.2 Industrial Land Use Zone	Over 75% of its landmass is in public ownership (73% federal, 3% state), so coordination with state and federal agencies is imperative. Efforts are made to attract commercial development including Kootenai Business Park's water system.	2
1.3 Natural Gas Line	The closest natural gas providers are in Bonner's Ferry, Idaho (52 miles west) and Kalispell, Montana (89 miles east). No natural gas is available in south Lincoln County.	4
1.4 Electrical	There are two primary electric feeds to the Kootenai Business Park. Electric service in Eureka and northern Lincoln County is provided by Lincoln Electric Co-op. Flathead Electric Cooperative provides electrical service in the City of Libby and in the surrounding area.	3
1.5 Fresh Water Supply Line	Water rights from Libby Creek provide for total available usage of 12,322-acre-feet per year or 11 million gallons per day.	2
1.6 Sewage Disposal Trunk Line	Treatment is provided by two facultative lagoons with a capacity of approximately 13,000 gallons per day.	3
1.7 Drainage	Wastewater treatment systems in Lincoln County are primarily individual septic drain field systems.	4
1.8 Stormwater Management	Lincoln County Implementation Action Plan intends that all commercial, industrial, and residential developments will have adequate stormwater management facilities.	4
1.9 Available ICT Services	The Lincoln County Port Authority will undertake the necessary planning and required infrastructure such as cell towers and additional fiber cable.	2
1.10 Available Land	About 70% of land is owned by the federal government.	2
1.11 Cost of Land - Initial Cost	Land listed at competitive rates.	2
1.12 Cost of Land - Property Tax, Utilities	Because of its large amount of untaxable federal land, Lincoln County receives federal dollars from the Payment In Lieu of Taxes (PILT) program.	4
1.13 Infrastructure - Landfill/waste disposal	Solid waste and wastewater treatment facilities are both available nearby.	1
Category 2: Logistics		
2.1 Highway Access and Intersection	There is ample Highway access. The main corridors through the County are US Highway 2 (connecting Libby and Troy with Kalispell and Idaho), US Highway 93 (connecting Eureka with Canada and Whitefish), and Highway 37 (connecting Libby and Eureka).	2
2.2 Proximity to Major Markets	Good rail and road transportation. Major markets can be reached through a variety of routes in an efficient and timely manner.	2
2.3 Accessibility to Airport	Lincoln County has airports in Troy, Eureka, and Libby.	3
2.4 Railway Service	The Burlington Northern Sante Fe (BNSF) line in south Lincoln County provides an important freight rail connection for Lincoln County.	2
2.5 Logistics - Construction Logistics	Reasonable. Several new construction projects underway.	4
Category 3: Social Infrastructure		
3.1 Quality of Life	Lincoln County's citizens enjoy a rural, friendly, and independent lifestyle.	3
3.2 Education - Elementary & High School	Fair. Education levels in Lincoln County are lower than the statewide average.	6
3.3 Education - Post Secondary	Fair. Many of Lincoln County residents on pursuing a bachelor's degree or a graduate degree.	6
3.4 Local Retail	Retail trade employs 12% of the working class.	2
3.5 Culture and Recreation	Public lands benefit Lincoln County by providing scenic beauty and economic opportunities in recreation, hunting and fishing, restoration work, forestry, and tourism.	1
3.6 Hospital and Doctors	Fair. Health care services provide 18% employment in Lincoln County.	4
3.7 Housing Availability	44,640 acres in Lincoln County were converted to single-family housing between 1990 and 2016.	4
3.8 Crime Rate	The crime rate in Lincoln is 18.95 per 1,000 residents per year. People who live in Lincoln generally consider the northeast part of the county to be the safest.	4
	Total	***3***

Bioeconomy Development Opportunity Zone Program Advisory Committee—Libby, Montana

Jordan Solomon, Ecostrat

Mark Peck, Lincoln County

Jerry Bennett, Lincoln County

Julie Kies, USDA Forest Service

Gary Kedish, USDA Forest Service

Tom Perry, Montana DNRC

Brian Hobday, Green Diamond

Dave Friedman, American Forest Management

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Todd A. Morgan, UM-BBER (Bureau of Business and Economic Research)

Michael Niccolucci, UM-BBER (Bureau of Business and Economic Research)

Table of Contents

APPENDIX A: RISK INDICATOR SCORING METRICS

CATEGORY 1: SUPPLIER RISK

1.1. Longevity & History of Supplier Performance

Rationale: Number of years in business is a positive indicator of future solvency. Historical performance is an indicator of future performance.	
Raw RI Score: The history of the forest industries in Idaho and Montana dates back to the 1840s. Sawmills have seen a decline since 1981, with numerous smaller mills being replaced by larger capacity mills. The long history of forest industry in the Libby BDO Zone coupled with overall longevity of sawmills in the area means risk related to longevity and history of supplier performance is deemed low. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100.	**Score 6.66**

1.2. Production Capacity

Rationale: Supplier production capacity can be a strong indicator of long-term credit worthiness and future solvency. Higher production capacities can denote strength of operational elements, including cash flows, important to future solvency.	
Raw RI Score: **Sawmill Residuals:** A smaller number of larger capacity mills have replaced more numerous smaller mills over decades in the Libby BDO Zone. Currently, 8 sawmills generate an estimated 450,818 green tons per year (gt/yr) of Sawmill Residuals in the Zone. Assuming a capturable range of 10% to 20% for Sawmill Residuals and that a new operator can access the fiber, we estimate that ~ 67,623 gt/yr could be available if satisfactory pricing is offered. **Forest Residuals:** Numerous logging companies generate an estimated 273,088 gt/yr of Forest Residuals. Assuming a capture ratio of 55%, research for this rating suggests ~150,198 gt/yr are likely available to new bio-based markets. **Pulpwood:** Pulpwood is currently an untapped resource. Without markets driving a demand for this wood, incentives to remove and utilize it are lacking. Pulpwood in the Supply Basin is estimated at 85,907 gt/yr. Applying a capture ratio of 25%, we estimate 21,476 gt/yr are likely available. Risk associated with supplier production capacity is overall deemed low. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**

Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100.	**Score 6.66**

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

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

Raw RI Score: **Score 1**

Sawmill Residuals: In most cases, long term relationships with Sawmill Residual markets are already established in the Libby BDO Zone. Companies operating in the area account for consumption of over 95% of the available Sawmill Residuals produced by primary wood product manufacturers. While we believe that sawmills are likely to seek the most cost effective, logistically feasible, and viable means to sell Residuals they produce and may be receptive to expanded market outlets for their Residuals, we find it unlikely that a new market could secure large volumes of Sawmill Residuals without paying a price premium. We find it also unlikely that sawmills would divert significant quantities of Residuals from existing historical markets at any price premium. Because we are uncertain about the ability of current markets to compete on price and the quantity of Residuals that would be diverted from existing markets at a price premium, we find material risk in Sawmill Residuals for new markets in the Zone.

Forest Residuals: There is significantly more potential supply than existing demand for Forest Residuals. Suppliers will deliver to any viable market with no inherent preference. Forest Residuals would be available on the open market.

Pulpwood: The closure of a Pulp Mill in the Libby area within the last 10 years has resulted in a lost market outlet for Pulpwood and consequently depressed production. Currently, incentives to removing it during thinning or harvests are limited to contractual mandates. We believe that Pulpwood production in the Libby BDO Zone is capable of material increases with sufficient market demand. A facility capable of utilizing this material would be well-positioned to capture a consistent supply of Pulpwood.

We deem risks associated with supplier dependence on, or preference for competing markets, to be high for Sawmill Residuals and low for Forest Residuals and Pulpwood. Since we discount Sawmill Residual quantities in the Libby BDO Zone Rating, we include only Forest Residuals and Pulpwood. Raw RI Score is 1 out of 10.

Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**

Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100.	**Score 3.33**

1.4. Supplier as a Competitor

Rationale: The risks of feedstock costs going up and availability going down increase if a supplier is also a competitor to the Proponent. In times of feedstock shortage, the risk that supply commitments will not be met increases.

Raw RI Score: **Sawmill Residuals:** We have noted that Sawmill Residual markets are currently mature and that any new facility looking to source this material can expect barriers to securing it. It is common for sawmills to use Sawmill Residuals, most often sawdust and bark, as fuel for internal operations. Most sawmills burn a fraction of the Sawmill Residuals they generate, but some burn most of their sawdust and bark. Although not foreseeable in the near future, if natural gas prices increased to a point where mills relied more on their own residuals, this would drive scarcity and put upward pressure on price. **Forest Residuals and Pulpwood:** Suppliers do not act as potential competitors for Forest Residuals and Pulpwood. Risks related to suppliers acting as competitors is overall low. Raw RI Score is 1.	**Score 1**
Notched Salience: Given sufficient price incentive, we believe that sawmills currently using Residuals for heat could consider committing fiber supply and substitute previously utilized Sawmill Residuals with natural gas. However, since the price differential to incentivize switching is high, there is no adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100.	**Score 3.33**

1.5. Ownership of Land/Means of Production

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

Raw RI Score: **Forest Residuals:** Though neither sawmills nor fiber producers/harvesters typically own the land where they harvest, we do not find this poses a risk to the availability of Forest Residuals. As historical data show, timber in this area is available for harvest continually year-to-year. We deem risks related to ownership of land and means of production to be low. Raw RI Score is 1 out of 10.	**Score 4**

Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 6.66**
Loaded RI Score: The Loaded RI Score (Notched Salience × Impact Level) is 26.64 out of 100.	**Score 26.64**

1.6. Ownership of Equipment

Rationale: In most cases, suppliers that own or lease equipment for harvest, collection, and processing feedstock are lower risk than those who do not. For example, third-party harvesting equipment may not be available when required. Short harvest windows may be missed if a contractor cannot schedule harvest times that are convenient and quantity shortages can result.	
Raw RI Score: We see no significant risk with required equipment ownership from sawmill of fiber producers. Producers in the Libby BDO Zone region either own the equipment necessary to harvest and collect timber and other forest products, including Forest Residuals, or have easy access to it. Therefore, risk is introduced where new equipment is needed to accommodate new buyer specifications. Anecdotal evidence from conversations with stakeholders suggests a willingness for such investment if buyer commitments are stable. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100.	**Score 3.33**

1.7. Ownership of Transportation/Logistics

Rationale: In most cases, suppliers that own or lease equipment necessary to transport biomass from forest or field are lower risk than those who do not. However, in some circumstances, reliance on third-parties to transport biomass is a common practice and does not contribute to risk.	
Raw RI Score: Woody biomass transport often requires open-top or live-bottom trailers. Fiber producers in the Libby BDO Zone typically handle transportation in their own trucks or, to a much lesser degree, through a contracted third party. We note stable trucking infrastructure with multiple transport companies in the Zone; many of these companies operate a small number of trucks. If outsourced, transportation would likely have to be contracted to a small number of major trucking companies or a large number of smaller ones. Sawmill Residuals are transported in company-owned trucks. In instances where additional hauling capacity is required, no red flag was noted with trucking companies in the area. See Appendix D. Risks associated with transportation/logistics are deemed low. Raw RI Score is 1.	**Score 1**

Notched Salience: Given existing infrastructure of available trucking contractors, we assume that distribution and transportation needs can be adequately met**.** No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100.	**Score 6.66**

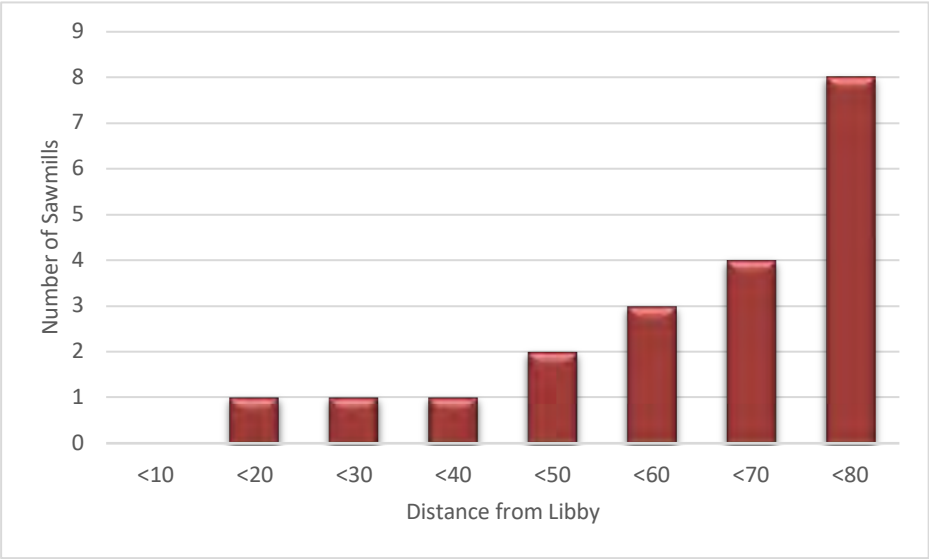
1.8. Supplier as an Aggregator or Broker

Rationale: Aggregators may effectively provide supply chain redundancy and eliminate the risk and complexity of dealing with multiple sources of supply by combining supplies into a single master contact. Aggregators can add much needed stability in BDO Zones by increasing offtake stability for both suppliers and markets. An aggregator can be a more reliable long-term offtake for suppliers by virtue of having multiple markets and can be a more reliable long-term supplier for markets by virtue of having multiple suppliers. Further, when a single supplier breaches, the aggregator can source from another.	
Raw RI Score: We know of no current aggregators or fiber brokers in the supply area. Sawmills and other fiber producers deal with markets directly. Risk associated with suppliers as aggregators or brokers is deemed low. Raw RI Score is 4 out of 10.	**4**
Notched Salience: Despite this fact, we see direct supply as fundamentally reliable with adequate redundancy in case of individual supplier failure. Raw RI Score is notched by **75%**: Notched Salience is 1.	**Score 1**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100.	**Score 3.33**

1.9. Distance from Proponent

Rationale: The greater the distance from a supplier to a plant, the more exposure it has to weather and fuel cost risks, and the greater the competitive pressure (to breach) that a closer competitor can exert.	
Raw RI Score: Since individual Sawmill Residual production values could not be obtained, we were unable to create a generation curve. For a proxy, we examined Sawmill distribution in the Libby BDO Zone, shown in the figure below. Eight mills are located within 80 miles of Libby. For reasons described previously, we foresee a low capture rate of Sawmill Residuals and discount the risk of proximity of competition for a new plant in Libby. Risks associated with Forest Residues and Pulpwood are directly related to weather or fire events. In such cases, predictions become difficult. To the extent that harvesting operations occur farther from Libby, the greater the corresponding risk in area that may be impacted by these variables. It is reasonable to conclude, however, that due to consistent forest harvesting, weather and fire represent only minor delays at worst case scenario for these fiber sources. Raw RI Score is 3 out of 10.	**Score 3**

Sawmill Distribution within Libby BDO Zone



Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 9.99 out of 100.	**Score 9.99**

1.10. Fundamental Feedstock Production Experience

Rationale: Risk is higher when a supplier has limited experience with harvesting/processing and/or collecting biomass. Where experience is lacking, Proponent should show that steps have been taken to ensure proper training, knowledge dissemination, and monitoring.	
Raw RI Score: Supply of Sawmill Residuals in the Libby BDO Zone is well established, as evidenced by the absorption of that material by current markets. Forest Residuals are a by-product of roundwood timber production and fiber, and it is clear that producers in the area have deep knowledge and experience of all aspects of generation. Lack of markets for Forest Residuals and Pulpwood means that producers' experiences in processing and handling Forest Residuals is understandably limited. As such, we see potential for moderate risk associated with supply Forest Residuals and, to a much lesser extent, Pulpwood feedstock production experience. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: We believe that existing producers can fairly easily develop the experience required to gather, process, load, and deliver Forest Residuals and Pulpwood. Raw RI Score is notched by 50%: Notched Salience is 2.5.	**Score 2.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 16.65 out of 100.	**Score 16.65**

1.11 Production Scale Experience

Rationale: Scale-up entails risk. Risk is higher when a supplier has limited experience with the production of the quantity of feedstock required.	
Raw RI Score: Suppliers in the region evidenced an eagerness to capitalize on a potential Forest Residuals and Pulpwood market[7]. Wood growth continues to outpace harvesting in the Libby BDO Zone. Forest managers are eager to have more options for fuels reduction and economical thinning to promote stand vigor. Pre-commercial and commercial thinning is a primary means of accomplishing these objectives. The infrastructure for this work is already in place in the Zone. Currently, the largest constraint for removing and utilizing Forest Residuals and Pulpwood is a lack of economically feasible outlets, not the harvesting infrastructure or the ability to scale it. . We acknowledge that production scale may require logging, transportation equipment, and tools that some suppliers may not have in the required quantities (such as chippers and live-bottom trailers). Acquiring this equipment would require fiber producers to incur a capital expense, which may not be feasible for some. Risk associated with production scale experience is deemed low-moderate. Raw RI Score is 3 out of 10.	**Score 3**
Notched Salience: Feedstocks that do not require new equipment, only additional time (such as in-woods whole-tree chips) could be prioritized to reduce the risk associated with RI 1.11. As a result, Raw RI Score is notched by 25%: Notched Salience is 2.25.	**Score 2.25**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 7.49 out of 100.	**Score 7.49**

1.12. Feedstock Production Priority

Rationale: When biomass feedstock is a secondary or non-core line of business, or when it is a by-product or a residual from a more valuable primary product, then suppliers may not put in sufficient effort to consistently produce it. Risk of breach increases when production and/or delivery of feedstock compromises a supplier's ability to make a primary product.	
Raw RI Score: We do not expect a negative impact on primary forest sector harvesting or production from increasing biomass production. Forest Residuals and Pulpwood production are not a high priority for fiber producers. They are a direct result of their primary product production. Anecdotal evidence from conversations with operators in the area suggests a strong willingness to engage in this activity if it is deemed profitable. Sawmill Residuals are a by-product of the timber processing industry and are a small but important part of overall revenue streams. While sawmills may reduce residual generation	**Score 2**

[7] Verbal communication with area loggers and foresters. April–May 2022.

with technological advances in sawing equipment, the overall impact on total output of fiber is likely to be low. Raw RI Score is 2 out of 10.

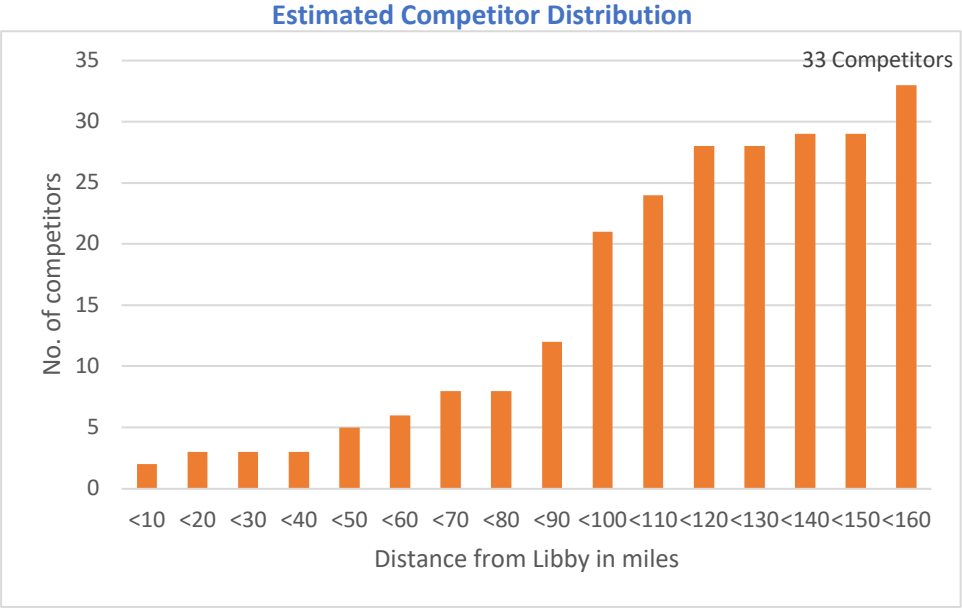
Notched Salience: By increasing competition in the market for woody biomass, we expect that a new bio-based facility would inherently incentivize residual generators to maintain their existing production. Biomass markets should incentivize fiber producers to process Pulpwood and larger quantities of logging waste into Forest Residuals feedstock. As a result, Raw RI Score is notched by 25%: Notched Salience is 1.5.	**Score 1.5**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 9.99 out of 100.	**Score 9.99**

CATEGORY 2: COMPETITOR RISK

2.1. Competitor Locations and Geographical Influence on the Market

Rationale: Competitors' locations relative to a Proponent plant can affect the viability of procuring feedstock and the cost of that feedstock. Accurate and detailed competitor mapping provides an understanding of the geographical influence a competitor may have, including competitive advantages such as short-hauling.

Raw RI Score: Thirty-three major competitors were identified within the 160-mile drive distance Competition Zone. Major competitors include pellet mills, medium-density fiberboard producers, and facilities using wood for heat. Two major entities currently compete for Sawmill Residuals. Distribution of competitors is shown in the figure below.	**Score 4**



The number of competitors is relatively low to about a 50-mile drive distance from Libby. Competition becomes more pronounced at >100 miles. Importantly, an estimated 95+% of all Sawmill Residuals are accounted for within a 160-mile radius of Libby.

Forest Residuals and Pulpwood, as indicated previously, are not utilized, making this material the most logical feedstock choice for a potential Proponent.

We discount the capture rate for Sawmill Residuals and allocate a Raw RI Score of 4 out of 10.	
Notched Salience: The majority of competitor consumption occurs >100 miles from Libby. In Libby, a potential facility could mitigate some of the risk associated with RI 2.1 through careful inventory planning, facility location, and a competitive pricing strategy. As a result, Raw RI Score is notched by 25%: Notched Salience is 3.	**Score 3**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 29.97 out of 100.	**Score 29.97**

2.2. Historical Fluctuation of Quantity Used

Rationale: Clear understanding of key competitors' consumption of each type of feedstock utilized by the Proponent is essential to quantifying the risks associated with each competitor. Understanding historical trends of feedstock utilization can provide valuable information about feedstock price elasticity during shortages and insight into events that may impact future supply conditions. It can also enable more accurate estimates of the sensitivity of feedstock availability to potential future consumption levels or to the impact of external events (e.g., weather events, structural economic changes, seasonality, or policy change).	
Raw RI Score: Limited data on estimated historical competitor feedstock intake is available. However, several observations can be made. Most significant is the current lack of a pulpwood market, which disappeared with the closing of a pulpwood-using facility near Libby in 2010. This has effectively de-incentivized the consistent removal of Pulpwood from forests in the surrounding area. Second, there is no current demand or market for Forest Residuals generated during forest harvesting. Lastly, the market for Sawmill Residuals is mature; this material is currently used for the production of medium-density fiberboard. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: A potential project could mitigate risk associated with the historical quantity fluctuations by creating a confirmed demand for available feedstocks that would incentivize loggers to access the material (Pulpwood and Forest Residuals). As a result, Raw RI Score is notched by 25%: Notched Salience is 3.75.	**Score 3.75**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 37.46 out of 100.	**Score 37.46**

2.3. Competitor Pricing and Price Sensitivity

Rationale: Understanding how much competitors pay for different feedstock types is an essential step in determining competitiveness of Proponent. Historical prices paid by competitors provide insight into their procurement behaviors and ability/willingness to pay premiums for feedstock and exert pressure on Proponent's	

suppliers during times of feedstock shortage. Competitors who are able to offer higher prices for feedstock during feedstock shortages can pose significant risks to Proponent.	
Raw RI Score: The Weyerhaeuser medium-density fiberboard (MDF) facility represents the most immediate competition to a potential project for Sawmill Residuals feedstock. In a bidding war for feedstock, it is likely that the MDF plant could outcompete a new bioprocessing facility for Residuals. We see material competitor pricing risk for Sawmill Residuals. Forest Residuals and Pulpwood are subject to much less intense competitive pressure at the present time. Raw RI Score is 4 out of 10.	**Score 4**
Notched Salience: We see material risk in large mills competing for Sawmill Residuals; these facilities are well established and may be able to tolerate higher prices temporarily in order to exert pressure on new competitors. However, we assume a conservative capture rate for Sawmill Residuals by a new plant and primary supply from Forest Residues and Pulpwood, where competition for feedstock is lower. As a result, Raw RI Score is notched by 50%: Notched Salience is 2.	**Score 2**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 13.32 out of 100.	**Score 13.32**

2.4. Impacts of Future Demands on Feedstock Availability and Price

Rationale: Future competitors for feedstock, or expansion of feedstock demand by current competitors, can cause feedstock market disruption.	
Raw RI Score: We identified one additional business proposing to operate in the Libby BDO Zone[8]. If successful, the firm would develop a medium-density fiberboard plant in Libby. The facility could support upwards of 150 jobs and consume an estimated 100,000 dry tons of fiber or woody biomass (135,000 gt/yr). One chipping operation established in 2012 has experienced intermittent production cycles. When running, the mill utilizes Forest Residuals in insignificant volumes compared to what is available. Raw RI Score is 8 out of 10.	**Score 8**
Notched Salience: Proponents entering into competition for Sawmill Residuals may have to engage in pricing wars, with uncertain parameters around pricing pressures that existing competitors may be able to exert. Increase in demand from existing competitors over time is a salient possibility. We see a significant first mover advantage to decreasing the risk of future demands on Forest Residuals and Pulpwood (long-term supply contracts are one possibility). As a result, Raw RI Score is notched by 25%: Notched Salience is 6.	**Score 6**

[8] https://dailyinterlake.com/news/2021/jul/13/hurdles-remain-bring-mdf-factory-Libby/?msclkid=97a7422fd14311ec82b0e7beb225e6ff.

Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 59.94 out of 100.	**Score 59.94**

2.5. Supply Influence of Competitor

Rationale: In some cases, competitors may be able to exert high degrees of pressure on local suppliers, effectively enabling them to control feedstock, especially during periods of shortage. This control can derive from long previous relationships between suppliers and competitors, from verbal or "understood" agreements, or from a competitor being able to assist suppliers in times of surplus by maintaining large inventories that enable suppliers to continue supplying when other markets impose quotas. Understanding and planning around these soft risk factors is important. If such relationships exist in the Proponent's procurement area, they may indicate increased risk of feedstock shortage or pricing changes.	
Raw RI Score: The closest 21 competitors are all within 100 miles of Libby. Existing mills currently utilize the majority of available Sawmill Residuals and are located within the 75-mile Libby BDO Zone. An additional facility is being considered for location in the immediate Libby area and could exacerbate this risk. However, Pulpwood and Forest Residuals would remain viable feedstock sources given that currently these materials are abundant and there is little to no demand for them. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: The Proponent would have some, albeit limited, means of mitigating the current flow of Sawmill Residuals to key competition in the immediate area, mostly via pricing premiums and distance advantages. Pulpwood and Forest Residuals, on the other hand, represent opportunities for a new Proponent to capitalize on. Given that previous demand for Pulpwood has disappeared and that Forest Residuals do not have a stable market, these feedstock sources should be readily available if loggers are incentivized to capture it. As a result, Raw RI Score is notched by 75%: Notched Salience is 1.25.	**Score 1.25**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 8.32 out of 100.	**Score 8.32**

2.6. Temporary Market-Driven Markets

Rationale: Alternative, non-traditional, market-driven competitors for feedstock can increase feedstock demand in unusual circumstances.	
Raw RI Score: No temporary market-driven competitors' markets for either Forest or Sawmill Residuals or Pulpwood were identified. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**

Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 3.33 out of 100.	**Score 3.33**

2.7. Demand for Competitors' Products

Rationale: Increased demand for a competitor's product can cause greater demand for feedstock by the competitor. For example, greater demand for biofuels due to a clean fuels policy can cause increased biofuel production by the competitor, thereby increasing demand for feedstock.	
Raw RI Score: Sawmills in the area pose no competition to new plant development since new markets in the Libby BDO Zone will not utilize sawtimber. On the contrary, increased production at sawmills would be beneficial to a new plant as additional feedstock would be available to the market. Predicting demand for medium-density fiberboard (MDF), the primary competing product, is difficult. Demand will likely be closely tied to furniture, flooring, and other key markets and could fluctuate. Price pressure on pulpwood is foreseeable at moderate risk. We note that Forest Residuals are not primary feedstocks for MDF manufacture and that this BDO Zone rating is primarily driven by availability of Forest Residuals. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk	**Score Unnotched**
Impact Level: RI Impact Leve is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100	**Score 3.33**

CATEGORY 3: SUPPLY CHAIN RISK

3.1. Biomass Availability Multiple (BAM)

Rationale: Biomass Availability Multiple (BAM) indicates the degree of redundancy in a Proponent's supply chain. BAM is the ratio of biomass feedstock available to a project, at costs, timing, and in quality feasible for the Proponent, divided by the project's feedstock requirements. BAM is a strong indicator of supply chain resilience when stressed by supply shortage and/or supplier breach.	
Raw RI Score: The BAM indicates redundancy of available feedstock within the Libby BDO Zone for a pre-defined project intake capacity. Forest Residuals, Pulpwood, and Sawmill Residuals constitute feedstock in this analysis. We estimate annual generation of woody biomass in the Libby BDO Zone at 809,813 gt/yr, defined by an 80-mile drive distance from Libby, and comprised approximately as follows: 450,819 gt/yr of Sawmill Residuals; 273,088 gt/yr of Forest Residuals; and 85,907 gt/yr of	**Score 2**

Pulpwood[9]. Of this total, we estimate that approximately 256,479 gt/yr is available from current suppliers. However, we believe that only Forest Residuals and Pulpwood can function as strong levers for new market development because demand for Sawmill Residuals is high.

We note that market demand for Forest Residuals is low: the bulk of potentially available Forest Residuals is currently unutilized by competitors in the Libby BDO Zone. The majority of Forest Residuals are either left in the forest after harvest or burned on site. Assuming a capture ratio of 55%, we believe that approximately 150,198 gt/yr of Forest Residuals are likely available to new bio-based markets in the Zone.

Demand for Pulpwood saw a dramatic decrease in the Libby BDO Zone with the closure of a prominent pulp mill in the area. Absent a high level of market demand, harvesting of Pulpwood is being conducted at greatly reduced levels in comparison to previous decades. Pulpwood removal is an important component of forest management: foresters and land managers in the Zone will support the development of new market outlets for Pulpwood to aid silvicultural and hazardous fuels reduction objectives[10]. At the present time, removals occur primarily during pre-commercial and commercial thinning or when written into logging specifications on a job-by-job basis (i.e., when a logging contract stipulates that Pulpwood must be removed). Assuming 85,907 gt/yr of Pulpwood in the Libby BDO Zone, we apply a reasonable capture ratio of 25% to derive an estimate of 21,476 gt/yr of Pulpwood that would be available commercially to a new bio-based project in the Zone.

For the purpose of this rating, we see large quantities of Sawmill Residuals as functionally unavailable for new plant development. Currently, Libby BDO Zone sawmills commit nearly all Residuals to existing markets in the Competition Zone[11] or use them internally for kiln drying and facility heating. Estimates for Sawmill Residuals were generated using FIA and Timber Product Output data examined by the University of Montana-Bureau of Business and Economic Research in May 2022. We assume a capture rate of 10% to 20% for Sawmill Residuals because we are unable to estimate the ability of current markets to drive price and on reduced haul distances of a new plant versus existing markets. On that basis, we find it reasonable that ~67,623 gt/yr could be available at current market prices.

We assume a potential new bio-based Project in the Libby BDO Zone would have a feedstock intake requirement of up to 100,000 gt/yr. On the basis of the foregoing, we arrive at a BAM of 2.56, which indicates acceptable levels of resiliency and opportunity for the feedstock supply chain in Libby, Montana.

Raw RI Score is 2 out of 10.

Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 6.66 out of 100.	**Score**

[9] We define Pulpwood in this report as trees 5 to 11 inches in diameter at breast height (dbh).

[10] Verbal communication with Foresters, Land Managers, and Loggers in the Libby Supply Basin. April–May 2022.

[11] Defined by a 160-mile drive distance from the Libby BDO Zone center point.

	6.66

3.2. Impact of Increased Utilization of Feedstock

Rationale: Feedstock utilization in a Libby BDO Zone can change over time. Existing consumers of feedstock can expand operations or new facilities can enter the market. Increased utilization puts additional pressure on feedstock and can lead to higher prices, feedstock disruptions, shortages, or supplier breach.	
Raw RI Score: With a BAM (Biomass Availability Multiple) of 2.56, we see space in the market for increased feedstock utilization without risking oversaturation and consequent upward pressure on prices, particularly for Forest Residuals and Pulpwood, which constitute the majority of currently unutilized feedstock. The increased utilization of Forest Residuals and Pulpwood would likely not impact forest health, as only a small portion of Residuals must be left behind for soil remediation and health. Removal of Pulpwood-sized material often improves forest stand quality and is viewed as beneficial. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate*.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 33.3 out of 100.	**Score 33.3**

3.3. Feedstock Supply Curve

Rationale: The greater the feasible transport distance, the more feedstock is accessible to the Proponent, but at a higher delivered cost. The feedstock supply 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.	
Raw RI Score: An estimated 790,392 gt/yr of feedstock is generated in the Libby BDO Zone. Total feedstock generation can be broken into Sawmill Residuals, Pulpwood, and Forest Residuals. Sawmill Residuals account for 450,819 gt/yr of feedstock generation (56%); Forest Residuals account for 273,088 gt/yr of feedstock generation (3%); and Pulpwood accounts for 66,485.58 gt/yr of feedstock generation (11%). Assuming these capture rates, we see no red flags when analyzing the relationship between supply and distance, but some minor uncertainty results from the fact that, due to the manner in which Forest Residuals and Pulpwood data are reported, Forest Residuals and Pulpwood cannot be mapped as accurately as Sawmill Residual generation. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**

Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100.	**Score 6.66**

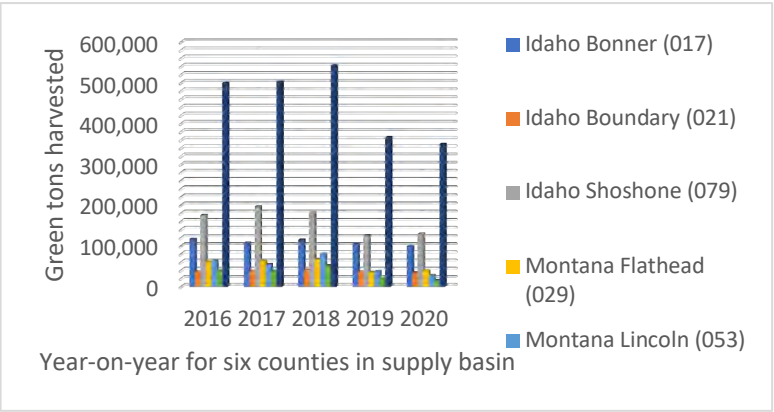
3.4. Seasonal Feedstock Supply Variation

Rationale: Biomass supply can present significant seasonal variations that in combination with limitations associated with longer-distance transportation and storage can lead to regional biomass supply imbalances (Golecha & Gan 2016) and manifest in shortages and higher costs for Proponents.	
Raw RI Score: Minor temporary delays in timber delivery to sawmills can occur during periods of heavy rainfall or major snow events, when fiber producers are unable to clear trees from timberland and/or dirt roads are impassable. These delays can cause variations in Sawmill and Forest Residuals as well as Pulpwood feedstock production. These delays (and therefore feedstock generation variations) typically do not last more than several weeks. However, the long-term impact of climate change on this RI is unknown and, as such, represents a minor but material degree of risk. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: Potential facilities could mitigate the risk associated with feedstock shortages during periods of inclement weather by maintaining moderate inventories (two to three weeks) of feedstock reserves on-site. With sufficient inventory, much of the risk associated with delays in feedstock production brought on by weather could be mitigated. Raw RI Score is notched by 25%: Notched Salience is 4.5.	**Score 4.5**
Impact Level: RI Impact level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 29.97 out of 100.	**Score 29.97**

3.5. Year-to-Year Variation in Feedstock Availability

Rationale: Biomass can have significant fluctuations in year-to-year supply due to variability in yield from biomass harvesting operations.	
Raw RI Score: Variation in the available forest feedstock is not seen as a significant risk for the purposes of this project. Indeed, anecdotal evidence from stakeholders in this area suggests that recent financial allocations for increased forest stand treatments may lead to increased cutting activity[12]. Sawmill Residuals track linearly with roundwood timber generation. Roundwood timber production was studied over time to understand year-to-year variations in Sawmill Residual feedstock generation. Historical data suggest minor risk of year-to-year variation in feedstock availability over time.	**Score 1**

[12] Verbal communication with foresters, land managers, and loggers in the Libby Supply Basin. April–May 2022.



Forest residues also track to harvesting levels. Given relatively consistent year-to-year harvest data coupled with evidence suggesting harvests may increase rather than trend downward, Raw RI Score is 1 out of 10.

Notched Salience: Forest regrowth outpaces forest harvesting in Montana and Idaho. With a new market for Forest Residuals, Pulpwood, and other woody biomass, it is likely that fiber producers would be incentivized to meet increasing demand for this material. Furthermore, a new market for Forest Residuals—made from chipped wood typically left in the forest—could help offset reductions in any roundwood or pulpwood generation during lower-production years. No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.6. Front-End Validation of Data Used in Feedstock Availability Models

Rationale: Feedstock supply models can be complex. Lack of clarity about model assumptions and baseline data can result in confusion on the part of the capital markets and drive financing costs for biomass projects. The adequacy and credibility of assumptions and baseline data is paramount to credible model outputs.	
Raw RI Score: We rely on data provided by the University of Montana-Bureau of Business and Economic Research in relation to the Libby BDO Zone. Staff performing the analysis are well versed in the use and understanding of Forest Inventory and Analysis data. Raw RI Score is 1.	**Score 1**
Notched Salience: No adjustments. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.7. Low Historical Demand for Feedstock in the BDO Zone

Rationale: If Proponent 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 early on.	
Raw RI Score: A total of 33 potential competitors were identified within the 160-mile drive distance Competition Zone. Major competitors include wood heating facilities, a medium-density fiberboard (MDF) plant, pellet mills, and a proposed new MDF facility in the Libby BDO Zone. The impact created when a nearby pulp mill closed its operations, creating a gap in demand for roundwood Pulpwood, is noteworthy. Pulpwood and Forest Residuals are not currently utilized and available for procurement. The infrastructure and expertise to capture this material exists. Competitors are discussed in more detail in Appendix C. An estimated total of nearly 450,819 gt/yr of Sawmill Residuals are currently consumed by competition. The variety and magnitude of competitor intake is a testament to the fact that feedstock collection practices are well established and at low risk for changing. Raw RI Score is 1 out of 10.	**Score 3**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low*.	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.8. History of Production/Feedstock is a Secondary Crop or a Byproduct

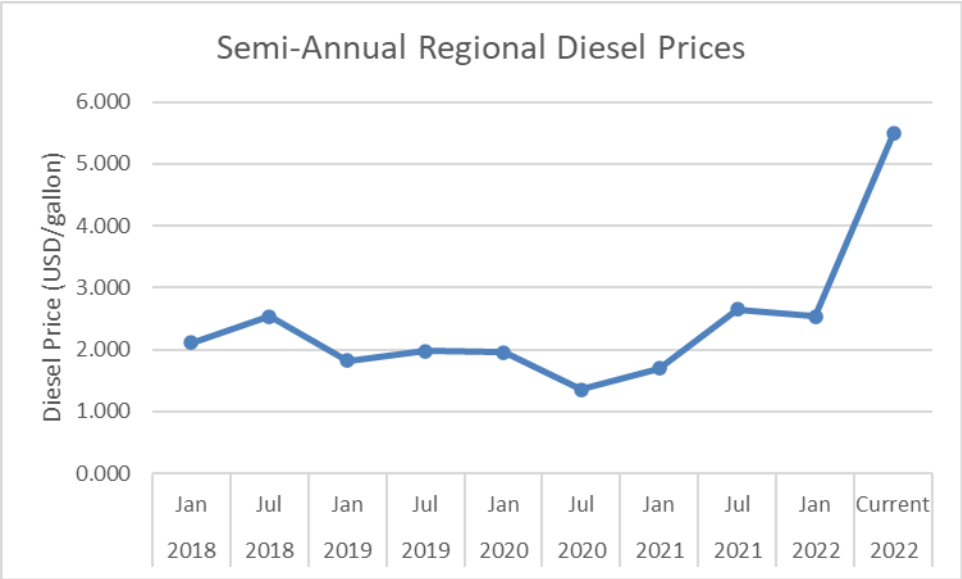
Rationale: If feedstock is a new/secondary crop or a by-product, suppliers may either lack sufficient experience to mitigate risk or be unable to react to such risk, and producers may be less likely to prioritize production. If feedstock is a secondary crop, then production can be subject to variables beyond suppliers' control.	
Raw RI Score: Forest and Sawmill Residuals as well as Pulpwood are by-products of sawtimber harvest and production in the Libby BDO Zone. Logging and wood products manufacturing are stable, with a long history of operation in the basin. If these industries were subjected to unforeseen crashes, both price and availability of woody feedstocks would be significantly impacted. Raw RI Score is 3 out of 10.	**Score 3**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *high*.	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 29.97 out of 100.	**Score 29.97**

3.9. Diesel Prices

Rationale: Diesel, oil, and PPI (Producer Price Index) can impact feedstock cost of harvest and collection over time. Sensitivities to worst case scenarios should be run.	

Raw RI Score: Regional data from the US Energy Information Administration's Diesel database show that diesel prices are volatile, hard to predict, and currently rising significantly[13]. Raw RI Score is 7 out of 10.	**Score 7**

Semi-Annual Regional Diesel Prices, 2018–2022



Notched Salience: Some of the risks associated with volatile fuel prices could be mitigated by a project engaging in, and favoring, contracts with suppliers located closer to Libby, reducing transportation costs. This would have the added benefit of reducing price pressure from larger and more abundant competition. As a result, Raw RI Score is notched by 25%: Notched Salience is 5.25.	**Score 5.25**

Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 34.96 out of 100.	**Score 34.96**

3.10. Harvest & Collection Practices & Schedules

Rationale: Differences in harvest timing and practices 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.	
Raw RI Score: Harvest, collection, and scheduling practices are well established and robust in the supply chain. Foresters and fiber producers have established procedures for forest management practices and the resulting timber harvest. However, risk is introduced if unforeseen factors such as inclement weather or extended periods of impassable roads occur. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: No adjustment.	**Score Unnotched**

[13] EIA's Monthly Retail Gasoline and Diesel Prices: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2DXL0_PTE_R1Z_DPG&f=M.

Impact Level: RI Impact level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100.	**Score 39.96**

3.11. Harvesting & Collection Equipment

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

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

Raw RI Score: It is industry standard that fiber producers own and operate all of their harvesting and collection equipment. However, some suppliers may need to make additional equipment purchases. Raw RI Score of 3 out of 10.	**Score 3**
Notched Salience: If there is a market, it is likely that any needed equipment will either be purchased by suppliers or provided by the project. As a result, Raw RI Score is notched by 25%: Notched Salience is 2.25.	**Score 2.25**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 3.33 out of 100.	**Score 7.49**

3.12. Temporary Externality-Driven Markets for Feedstock

Rationale: Alternative, non-traditional, externality-driven competitors for feedstock can drive feedstock demand (and cost) in unusual circumstances.

Raw RI Score: No temporary externality-driven markets for Sawmill Residual, Forest Residual, or Pulpwood feedstocks were identified. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.13. Variations in Densification Methods Among Different Suppliers

Rationale: The shape and density of the unit in which feedstock is supplied can impact feedstock cost and quality.

Raw RI Score: Densification methods among different suppliers do not vary significantly. While the quality of the feedstock will vary depending on the wood source and stage in processing, collection methods are typically industry standard. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 6.66 out of 100.	**Score 6.66**

3.14. Availability of Labor for Feedstock Production

Rationale: Skilled labor shortages can be difficult to remedy in the short term. Availability of suitable labor in an area can impact the ability to procure sufficient feedstock quantities on schedule. Labor risks are higher for facilities where supply chains are not yet active, or for Proponent's for whom large feedstock requirements or development of new (or expanded) supply chains demand significant additions to the local labor force.	
Raw RI Score: There may be some risk in logistics/transportation suppliers as the market grows**.** Our research indicated that finding labor for feedstock acquisition will not be difficult. Raw RI Score is 3 out of 10.	**Score 3**
Notched Salience: De-risking measures would include adequate worker wages and initial investments in training. As a result, Raw RI Score is notched by 25%: Notched Salience is 2.25.	**Score 2.25**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 7.49 out of 100.	**Score 7.49**

3.15. Feedstock Transportation Costs

Rationale: Transportation can be one of the most significant cost components of biomass supply chains. The average transportation cost and percentage of total feedstock cost attributable to transportation should be known.	
Raw RI Score: Transportation costs are primarily a function of fuel cost, distance, and labor cost. We assume operating rates at $115 to $120/hour, legal road weights of 25 to 32 green tons depending on truck size and fiber category, average drive speed of 50 mph, loading and unloading time of 1.3 hours, and average distance of 40–80 miles one-way to derive the following estimates on high/low transportation costs in the Libby BDO Zone:	**Score 3**

Transport		
Round trip (miles)	80	160
Truck size (green tons)	32	25
Total estimated trucking cost ($/ton)	10.65	21.15

Raw RI Score is 3 out of 10.

Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100.	**Score 19.98**

3.16. Transportation Distances

Rationale: Transport distances of 40–80 miles for biomass feedstocks are typical but larger distances are common. Where average transport distance from suppliers to Proponent is high, the supply chain is subject to greater sensitivities to risks, such as increases in diesel cost, weather impacts, mechanical breakdown, and the demand for feedstock from competitors closer to the source.

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

Raw RI Score: The majority of Sawmill Residuals are generated at distances greater than 35 miles from the center point of the Libby BDO Zone, and the spatial distribution of Forest Residuals and Pulpwood generation are difficult to model precisely. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 19.98 out of 100.	**Score 19.98**

3.17. Transportation of Feedstock Requires Specialized Equipment

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

Raw RI Score: Transportation of the woody biomass in the Libby BDO Zone does not inherently require specialized equipment. The majority of the feedstock presently moved within the Zone is transported with traditional open-top trailers or live bottom trailers. Anecdotal indications are that capacity to haul residual materials is widespread throughout the Zone[14]. If needed due to road or topography conditions, other forms of transport, such as dump trucks, are available. There may be a slight risk around lead times to accommodate specific transportation. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: Raw RI Score is notched at 25%. Notched Salience is 1.5.	**Score 1.5**
Impact Level: RI Impact Level is deemed *moderate.* While we expect local infrastructure to be able to scale as necessary to accommodate the specific transport needs of a new project, it could take some time to do so.	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 9.99 out of 100.	**Score 9.99**

3.18. 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 a Proponent's ability to transport feedstock. This risk is greater in greenfield projects than operational projects.	
Raw RI Score: Preliminary Geographic Information Systems (GIS) analysis confirmed an effective, intersecting, and expansive network of roads and highways in and out of Libby, Montana. Additionally, should a delivery route traverse a local community, feedstocks do not create unpleasant odors or visuals. Residents in the immediate area were significantly in favor of new projects that can help the local economy. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.19. Transportation Regulations & Local Weight Limits

Rationale: In many regions, transportation is regulated based on seasonal road conditions. These regulations (e.g., "frost laws") often take the form of weight restrictions or limits on the number of trucks allowed on roads. Such regulations can impede the project's ability to source sufficient feedstock or increase the cost of doing so at certain times of the year.	
Raw RI Score: Considering the volume and mass of timber currently transported in the Libby BDO Zone, we deem it highly unlikely that transportation regulations could hinder feedstock acquisition or transportation. Raw RI Score is 1 out of 10.	**Score 1**

[14] Verbal communication with foresters, land managers, and loggers in the Libby Supply Basin. April–May 2022.

Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.20. Road Infrastructure

Rationale: Feedstock cost and availability can be a function of the accessibility of road infrastructure**.** Problems with road networks will translate directly to risks to feedstock supply.	
Raw RI Score: Road infrastructure is good (although aged) and maintained at regular intervals. There is a proven track record of supporting the needs of a vibrant forest products and forest management network of activities. Forest roads, particularly in national forests (majority of supply), probably have higher risks of closure or disrepair than paved state and county roads. National forest travel plans, forest plans in general, and litigation around them can be issues. Raw RI Score is 4.	**Score 4**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 26.64 out of 100.	**Score 26.64**

3.21. Transportation Redundancy

Rationale: Transport equipment redundancy is important for dealing with seasonally variable feedstock supplies, as well as the risk of equipment breakdowns.	
Raw RI Score: Within the Libby BDO Zone logging companies typically own their own trucks, although some remove feedstock in combination with a contracted third party. Transportation redundancy in the Libby supply chain is low risk. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: It is expected that if there is a good market opportunity, either logging companies or a third party will be interested in participating. As a result, Raw RI Score is notched by 50%: Notched Salience is 1.	**Score 1**
Impact Level: Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 6.66 out of 100.	**Score 6.66**

3.22. Number, Size, Mix, & Locations of Suppliers

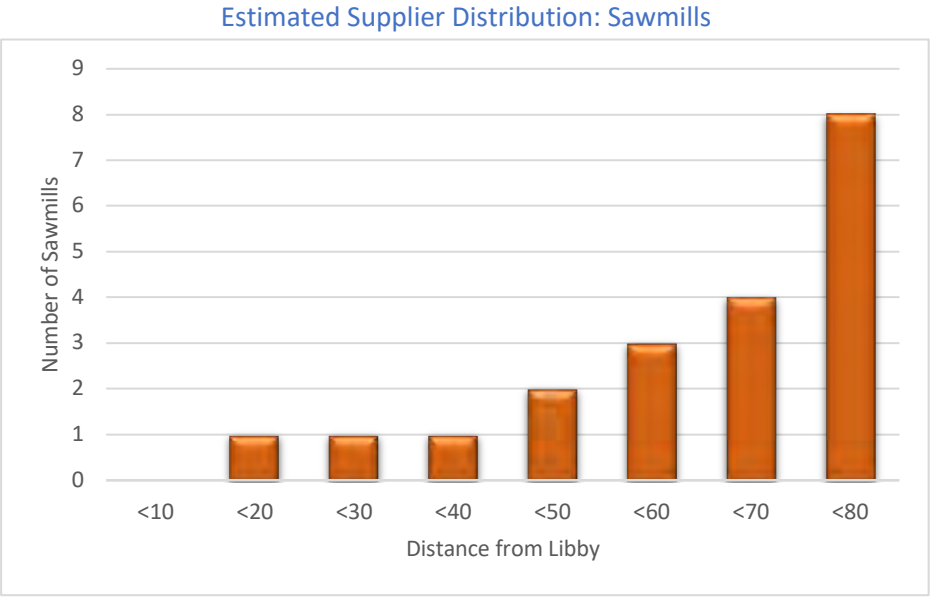
Rationale: In general, a portfolio of multiple suppliers of various sizes is important for ensuring steady and uninterrupted feedstock supply with minimal price fluctuations. If a	

small number of large suppliers 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, a large number of small suppliers is less likely to have the capacity to withstand internal disruptions and may be more likely to breach. Here, risk of disruption is higher, but the likely impact is lower. The number of suppliers and the ratio of small to large suppliers should be optimized.

There is no pre-determined number or optimal ratio of suppliers—either too many or too few can pose higher degrees of risk.

Raw RI Score: Twenty-eight potential suppliers were identified within the Libby BDO Zone: 8 sawmills, and 20 fiber producers (of either Forest Residuals and/or Pulpwood). **Score 2**

Additionally, fiber producers will typically travel from their home offices to wherever there is work. If they are located within the Libby BDO Zone, their distances from Libby are largely irrelevant and thus were not mapped.



The number and mix of potential suppliers in the Libby BDO Zone are advantageous for projects looking to site in Libby. However, the fact that 76% of potential suppliers operate outside of a 35-mile drive distance introduces a moderate level of risk of increases in diesel cost. Raw RI Score is 2 out of 10.

Notched Salience: No adjustment. **Score Unnotched**

Impact Level: RI Impact Level is deemed *low.* **Score 3.33**

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

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

Rationale: When a single risk event can impact the feedstock production ability of all (or most) suppliers, then feedstock risk is higher and supply chain resiliency is lower. Resilience is maximized when biomass supply chains exhibit diversity in their locations, production practices, and other elements of supply chain structure such that single, high-risk events have varying impacts on suppliers.	
Raw RI Score: Suppliers in the Libby BDO Zone are subject to many of the same external risk factors. Logging in the Zone is dependent on macroeconomic factors such as the housing market. Downturns can threaten sawmill viability and consequently impact harvest of sawtimber and Forest Residuals. Additionally, most of the fiber in the Zone is softwood, meaning that supply is also exposed to species-related risks (such as pest infestation) that could impact the Zone in adverse ways. Despite this, sawmills in the Libby BDO Zone have shown slight decreases in output from the period 2016–2020. Even so, production has stayed fairly consistent. As housing markets show signs of growth, the estimated demand for lumber rises. We anticipate continued consistent production. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: Impact level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 33.3 out of 100.	**Score 33.3**

3.24. Seasonal Weather Impacts on Feedstock Supply

Rationale: Seasonal weather impacts are defined as deriving from natural weather variations (e.g., spring thaws, rainy seasons, or dry seasons) as opposed to singular weather events (like fires, droughts, or hurricanes). Seasonal weather changes can be a significant risk factor affecting feedstock availability, quality, and price.	
Raw RI Score: Temporary delays can occur during periods of heavy rainfall or snows when fiber producers are unable to clear trees from timberland, or dirt roads are impassable. These delays cause variations in all sources of feedstock production, but the delays (and therefore feedstock generation variations) typically do not last more than a few weeks. There can be some seasonal delays in Forest Residual and Pulpwood generation, particularly in the spring, when in-woods chipping and harvesting can be hindered by thawing. Raw RI Score is 5 out of 10.	**Score 5**
Notched Salience: Since seasonal delays typically last days or weeks, having a modest but well-maintained feedstock reserve on site would significantly reduce the risk. As a result, Raw RI Score is notched by 50%: Notched Salience is 2.5.	**Score 2.5**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 24.97 out of 100.	**Score 24.97**

3.25. Long-Term Weather and Climate Trends

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

Raw RI Score: The greatest climate risk to the Libby area is drought. The predictability of forest fires is based on fuel loads and moisture levels in a given area: severe periods of dry weather subject forests to catastrophic fire events. Approximately 1 million acres burned in Montana wildfires in 2021[15]. This was the largest total since 2017—the state's previous record-setting season. The supply of available timber declines during periodic and seasonal wildfire activity. However, the sheer volume of timber available and the wide geographic area of the Zone can somewhat mitigate the effects of wildfire on a plant in Libby. Due to the size of the available forest resource, Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 39.96 out of 100.	**Score 39.96**

3.26. 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 operations of the Proponent, such as Loan Guarantees, or to the markets for products produced by the Proponent.

Raw RI Score: There are no government subsidies that could materially impact the cost or quantity of fiber in the Libby BDO Zone if withdrawn. We note grants that support thinning on lands owned by non-industrial private landowners but see the overall risk to or impact on Zone fiber quantity as nominal. The Federal Infrastructure Investment and Jobs Act recently awarded a portion of northwest Montana (largely Lincoln County) a $19.3 million grant to conduct forestry work that reduces the risk of catastrophic wildfire[16]. Raw RI Score is 2 out of 10.	**Score 2**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 6.66 out of 100.	**Score 6.66**

[15] https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.
[16] http://dnrc.mt.gov/divisions/forestry/forestry-assistance/forest-practices/best-management-practices-bmp-2.

3.27. Local, Provincial, & National Laws, Regulations, & Permitting Pertaining to Biomass

Rationale: Feedstock production that is directly dependent on local, provincial, or national laws or government regulations can pose greater long-term risk than feedstock that is not, since laws and regulations may be subject to amendment or repeal. If utilization of biomass requires specific permits (e.g., percentage removal of Forest Residuals 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.	
Raw RI Score: All harvests must adhere to existing state and federal laws/regulations regarding the development/implementation of timber sales and fiber harvest and removal. With respect to special restrictions on the biomass, we identified no local or state laws or regulations that would prevent or restrict biomass removal from Libby BDO Zone forests. Raw RI Score is 4 out of 10.	**4**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 13.32 out of 100.	**Score 13.32**

3.28. Backlash Against Biomass Development, Procurement or Usage in the Region

Rationale: Public backlash against biomass development in the Proponent region can directly impact Proponent's ability to procure, transport, trans-load, store, or utilize feedstock by affecting local policies, regulations, and Proponent's ability to obtain necessary permitting.	
Raw RI Score: There are several environmental organizations in Montana that actively opposed the development of a biomass energy plant on the University of Montana campus in Missoula and would likely oppose the development of any new wood products facility anywhere in Montana. Raw RI Score is 1 out of 10.	**Score 5**
Notched Salience: There is a history of forest-related litigation that can be mitigated by explaining the positive impacts of a new biomass facility in the area. Raw RI Score is notched by 50%: Notched Salience is 2.5.	**Score 2.5**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 24.97 out of 100.	**Score 24.97**

3.29. Feedstock Sustainability, Including Risks to Soil Quality, & Surface & Groundwaters

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

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

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

Raw RI Score: Fiber harvest in the Libby BDO Zone is carried out according to local regulations that have strong sustainability protocols. See Best Management Practices - BMP (Montana DNRC)[17] and Idaho Forestry Best Management Practices (University of Idaho).[18] Raw RI Score is 3 out of 10.	**Score 3**
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *moderate.*	**Score 6.66**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 19.98 out of 100.	**Score 19.98**

3.30. GHG Emissions from Production, Harvest, & Transport

Rationale: Understanding a project's overall emissions and the carbon intensity throughout the feedstock supply chain is essential to reducing risks related to carbon pricing mechanisms and related regulations.

GHG emissions from production, harvest, and transportation can be a significant challenge to Proponent's claims of carbon neutrality for biomass projects. Carbon emissions from harvested soils, as well as emissions from harvesting machinery or delivery trucks, can make it difficult to achieve net-zero greenhouse gas (GHG) emissions. If a Proponent's financial model relies on carbon neutrality/GHG regulatory pricing frameworks, it is essential to investigate the feedstock's carbon emission status.

Raw RI Score: If we assume that: 1) trucks average 6.5 miles per gallon[19]; 2) all feedstocks must be transported 75 miles; 3) trucks can carry ~22 tons per delivery; 4) facility intake requirement is 100,000 tons per year; and 5) 19.64 pounds of CO_2 are emitted per gallon of fuel used[20], approximately 1,545 tons of CO_2 would be emitted per year in feedstock transport. However, average CO_2 carbon sequestration for pine trees is approximately 11 tons per acre of new tree growth[21], meaning only 140 acres of new trees would have to be grown per year to sequester all the carbon emitted from feedstock transportation. Given	**Score 2**

[17] http://dnrc.mt.gov/divisions/forestry/forestry-assistance/forest-practices/best-management-practices-bmp-2.
[18] https://www.uidaho.edu/extension/idahoforestrybmps.
[19] Arrow Truck: https://www.arrowtruck.com/blog/2016/06/21/manage-your-semi-trucks-fuel-use-with-these-tips/.
[20] US Energy Information Administration: http://www.patagoniaalliance.org/wp-content/uploads/2014/08/How-much-carbon-dioxide-is-produced-by-burning-gasoline-and-diesel-fuel-FAQ-US-Energy-Information-Administration-EIA.pdf.
[21] GoTree Quotes: https://www.gotreequotes.com/how-much-co2-do-trees-absorb/.

the scale of the forestry industry in the Libby BDO Zone, net positive carbon sequestration in relation to transport is deemed likely. GHG emissions stemming from feedstock production and harvest are more difficult to model and will depend on the size of the intake of a new plant in the Libby BDO Zone. However, we note the positive growth to drain ratio for fiber in the Zone at the present time. Raw RI Score is 2 out of 10.	
Notched Salience: No adjustment.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Notched Salience) is 6.66 out of 100.	**Score 6.66**

3.31. Geographic Location Influence on Feedstock Variability

Rationale: Feedstock from different regions may differ in quality due to variations in soil quality, topography, harvest practices, weather, fertilizer applied, etc.	
Raw RI Score: Geographic location within the Libby BDO Zone does not impact feedstock variability. While there is topographic variation throughout the forests in the area, these factors are not expected to impact the overall homogeneity of the categories of feedstock in this BDO Zone rating. Raw RI Score is 1 out of 10.	**Score 1**
Notched Salience: No adjustment. De-risking measures are not necessary for risk indicators with Raw RI Scores of 1, as they are already the lowest risk.	**Score Unnotched**
Impact Level: RI Impact Level is deemed *low.*	**Score 3.33**
Loaded RI Score: Loaded RI Score (Raw RI × Impact Level) is 3.33 out of 100.	**Score 3.33**

3.32. Capacity of Supply Chain Components & Equipment to Scale

Rationale: Scale-up risk increases if supply chain components or underlying feedstock infrastructure necessary for these components cannot scale to handle Proponent feedstock requirements and throughput capacity. Capacity to scale should be demonstrated.	
Raw RI Score: Supply chain equipment is intensive, and scaling capacity would require capital investments from potential suppliers. Raw RI Score is 6 out of 10.	**Score 6**
Notched Salience: Outreach to local suppliers suggested that they would make this investment given a reliable new market for fiber in the Libby BDO Zone that would intake on a consistent basis and pay market prices. Raw RI Score is notched by 75%: Notched Salience is 1.5.	**Score 1.5**
Impact Level: RI Impact Level is deemed *high.*	**Score 9.99**
Loaded RI Score: Loaded RI Score (Notched Salience × Impact Level) is 14.98 out of 100.	**Score 14.98**

APPENDIX B: BACKGROUND RESEARCH

1. INTRODUCTION

This appendix provides background research conducted for this Libby BDO Zone rating designation. It sets out the context of the research and discusses results related to supply, demand, and pricing of woody biomass in the Libby BDO Zone.

1.1 BDO ZONE, COMPETITION ZONE AND INCLUDED COUNTIES

The Libby BDO Zone is defined as an area within an 80-mile drive distance of Libby, Montana. Supply analysis for this study was conducted on the state and county levels when granular data was available. The six counties included in the Zone are summarized in Table A. Distances in Table A are measured from the center point of Libby to the center point of the respective county.

The Libby BDO Zone is depicted in Map 1 in blue. A Competition Zone is defined by a drive distance double that of the Zone, or a 160-mile drive distance from Libby.

Map 1: Libby BDO Zone and Included Counties

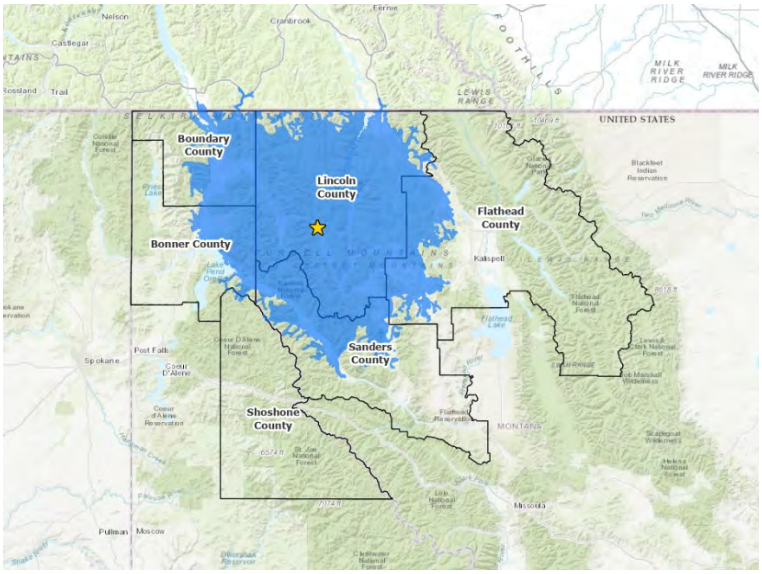


Table A: Counties within the Libby BDO Zone

Sr No.	County FIPS	County Name	State	Distance from Libby (Miles)	Approximate Percentage of County in BDO Zone
1	16017	Bonner	Idaho	88	27%
2	16021	Boundary	Idaho	46	50%
3	16079	Shoshone	Idaho	118	1%
4	30029	Flathead	Montana	124	13%
5	30053	Lincoln	Montana	60	87%
6	30089	Sanders	Montana	103	30.63%

1.2 Feedstock Definitions

This Libby BDO Zone designation includes Forest Residuals, Pulpwood, and Sawmill Residuals, defined below.

Specific feedstock, as defined below, are capitalized (i.e., Pulpwood, Forest Residuals, and Sawmill Residuals).

Forest Residuals

Forest Residuals are by-products of sawtimber and pulpwood harvesting[22]. Forest Residuals include tree crowns, branches, stumps, and unmerchantable stems. Collectively, this material is commonly referred to as "slash." Forest Residuals are: 1) left on site to degrade naturally; 2) aggregated on site and burned; or 3) piled roadside. Material transported off site is loaded in either open-top van trailers or live-bottom trailers. For the defined BDO Zone, the material is seldom chipped or ground on site. This varies by market as well as the ability of processing equipment to access the site.

Ash content of Forest Residuals can range between 1% and 6%, depending on composition. Where Forest Residuals contain mainly unmerchantable stems, the ash content is low; where Forest Residuals contain higher proportions of branches, or where the harvesting process fails to keep the fiber clean of soil or debris, the ash content is higher. The moisture content of the Forest Residuals is seasonal, ranging from 45% to 50%.

Sawmill Residuals

Montana and Idaho sawmills produce primarily dimension lumber used in construction and a smaller portion of structural timbers and veneer[23]. Approximately 50–55% of the volume of a sawlog processed by a sawmill is converted into primary wood products (e.g., lumber). The rest of the log is classified as co-products (residual material), composed of four main types: chips, sawdust, shavings, and bark (hog fuel). These are not always kept separate; if chips are mixed with sawdust, shavings, and/or bark, they are referred to as Hog Material in this report.

1.3 Methodology for Estimating Feedstock Generation

Sawmill and Forest Residuals, as well as roundwood Pulpwood feedstock generation, was modeled with 2021 data from the FIA's Timber Products Output (TPO) Toolkit and industry-appropriate transfer functions. See Appendix C for details and sources pertaining to generation estimates.

If part of a county landed in the Libby BDO Zone, it was assumed that the approximate percentage of the county within the Zone was the percentage of that county's feedstock generation produced within the Zone and counted towards the Zone's total. For example, approximately 13% of Sanders County, Montana, lies within the Libby BDO Zone, so 13% of the estimated residual generation within Sanders County was counted towards the Zone total. The percentage of a county in the Zone was estimated using Geographic Information Systems (GIS) modeling.

Where appropriate, we contacted stakeholders, local experts, and forest industry members to contextualize and validate the numeric modeling outputs and assumptions made throughout this report.

[22] Sawtimber is large diameter timber processed by sawmills into lumber; pulpwood is small diameter timber processed by pulp mills into pulp and paper.

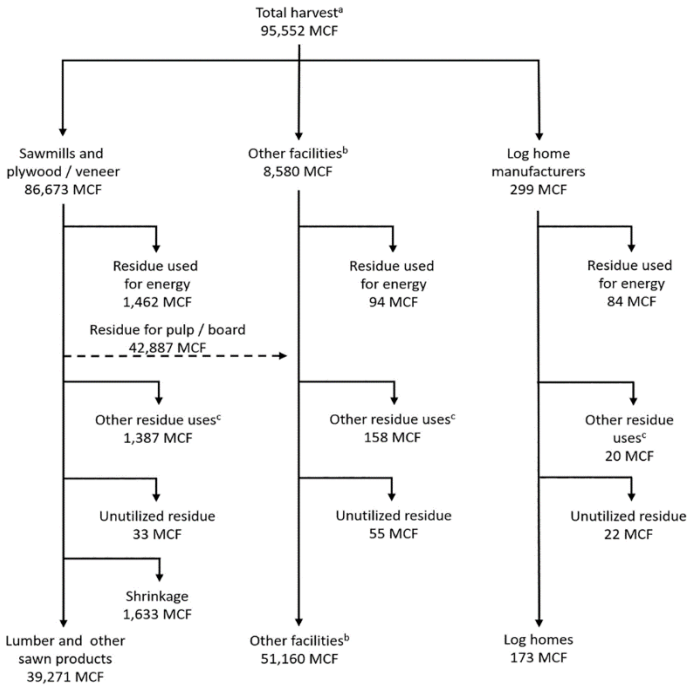
[23] Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.

2. Supply

2.1 High-Level Supply: Feedstock Generation

To illustrate harvesting and production in the area, consider Montana (statewide) summary data for 2018[24]. Ninety-three percent of that harvest activity went for saw and veneer logs. Other products, including logs for Pulpwood, furniture, fuelwood, cedar products, and posts and poles, accounted for just over 6%[11]. This illustrates the dominance of saw and veneer logs as well as the lack of markets for Pulpwood. While this data is for the entire state, the trend holds for the Libby BDO Zone, which is in northwest Montana, where much of the state's wood is produced. The same data source further broke down the flow of timber, noting that 86.7 million metric cubic feet (MMCF) of timber was received by sawmills and plywood plants in Montana. Of this, 39.3 MMCF, or 45%, became finished lumber, other sawn products, or plywood. Two percent was accounted for by losses during shrinkage. The remaining 45.8 MMCF was byproducts of sawing and became residue. The Sawmill Residuals were utilized as follows: 1.5 MMCF was sold or used internally for biomass energy; 43 MMCF was used for pulp, particleboard, and medium-density fiberboard; and the remainder went to animal bedding, mulch, or other uses. A much smaller component of timber went to manufacture log homes. We note that only 0.13 MMCF became mill residue, the bulk of which went for energy use. Interestingly, 17% of the residue generated by log home manufacturers went unused[11]. Figure 1 was developed by Hayes et al. and is presented here to illustrate the timber flow[25]. Full credit for Figure 1 is ascribed to its original author.

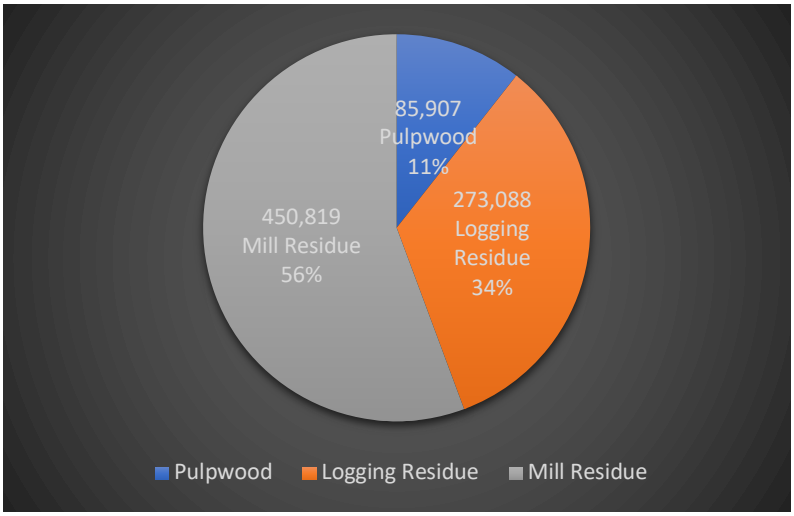
Figure 1: Timber Harvest Flow for Montana in 2018[25]



If the scope is refined to the Libby BDO Zone, currently an estimated 809,813 gt/yr of feedstock are generated. Sawmill Residuals account for 450,819 gt/yr (56%), Forest Residuals account for 273,088 gt/yr (34%), and Pulpwood makes up the remainder at 85,907 gt/yr (11%) (see Figure 2 below).

[24]Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.
[25] Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.

Figure 2: Estimated Feedstock Generation by Type in the Libby BDO Supply Basin



We estimate that 247,740 of the 790,392 gt/yr are available on average in the current market. Assuming that 1) a new competitor entering the market locates in a geographically strategic way within the Libby BDO Zone; and 2) the new competitor can capture access to available fiber, it is reasonable to expect the following availability:

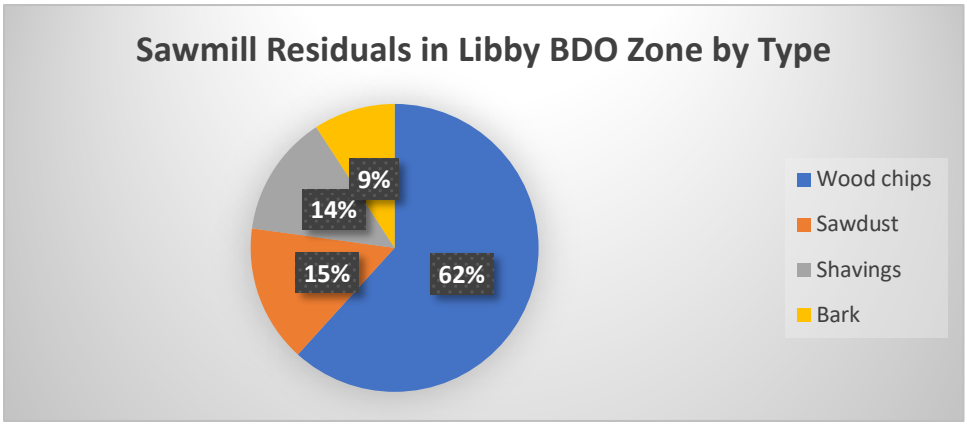
1. For a capture ratio of between 10% and 30%, an estimate of 29,919 gt/yr of Pulpwood[26].
2. For a capture ratio of between 50% and 60%, an average of 150,198 gt/yr of Forest Residuals.
3. For a capture ratio of between 10% and 20%, an average of 67,623 gt/yr of Sawmill Residuals.

This results, on average, in a potential availability of 256,479 gt/yr of these combined feedstock sources.

2.2 Sawmill Residual Generation

An estimated 450,819 gt/yr of Sawmill Residuals are generated in the Libby BDO Zone. The Residuals come primarily from mid- to large-sized sawmills and are composed of chips, bark, shavings, and sawdust. The Residuals break down by type and amount as follows: Chips: 278,283.03 gt/yr (61.73%); Sawdust: 69,570.76 gt/yr (15.43%); Shavings: 61,619.81 gt/yr (13.67%); Bark: 41,344.91 gt/yr (9.17%). See Figure 3.

Figure 3: Estimated Sawmill Residuals Generated in the Libby BDO Zone



[26] We assume that an even greater proportion of Pulpwood would become available if there were demand for it.

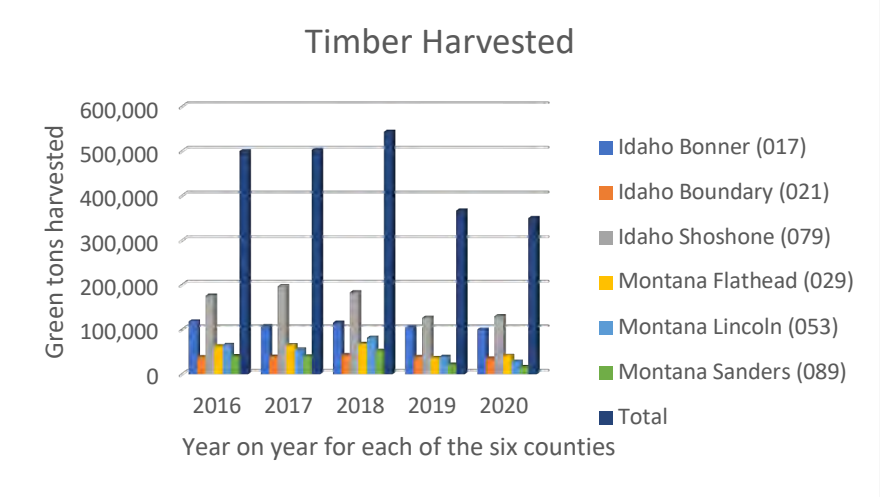
2.3 Year-to-Year Generation Variation

Sawmill Residuals

Since Historical Sawmill Residual generation data were unavailable, we used roundwood production data as a proxy to understand year-to-year variation in Sawmill Residual generation[27]. As shown in Figure 4 and Table B, the year-to-year production of roundwood in the Libby BDO Zone declined between 2016 and 2020. This reflects markets as well as available timber sales. Currently Pulpwood, without a stable market, is cut where mandated during timber harvests and commercial thinnings. There is otherwise little incentive at this time to cut this material, which is seen more as a cost associated with mature timber harvesting. While timber harvests declined from 2016 to 2020 (and thus Sawmill Residuals), stabilizing housing markets after the height of the COVID-19 pandemic in 2020, which are dependent on softwood construction lumber, are likely to turn this trend around. Understanding why these volumes fell would require data on the customers, the products sold, and terms of sale for timber cut throughout the entire period. Unfortunately, this information is not readily available[17]. Increased demand for construction lumber will translate into larger amounts of sawtimber is processed by primary wood users and correlates directly to increased Sawmill Residual production. Increased sawtimber demand also generates additional Forest Residuals and Pulpwood.

Timber Harvest data for the six counties over the period 2016–20 appears in Figure 4[28]. Shoshone and Bonner counties in Idaho have consistently had the highest harvesting levels, and Sanders County has had the lowest.

Figure 4: Estimated Historical Timber Harvested for Counties Falling in the Libby BDO Zone



[27] Residuals are the direct result of processing sawlogs into lumber and veneer. By applying a conversion of logs to lumber, we can estimate the remaining residue created.
[28] http://www.bber.umt.edu/fir/s_mt.asp, n.d.

Table B is provided for better resolution of the harvest volumes shown in Figure 4 for each county within the Libby BDO Zone[29].

Table B: Total Timber Harvested in the Counties Falling in Libby BDO Zone[a]

State	County	Year				
		2016	2017	2018	2019	2020
Idaho	Bonner	118,056	107,586	115,427	105,783	100,501
Idaho	Boundary	38,104	39,219	42,768	38,303	35,145
Idaho	Shoshone	175,862	196,915	183,469	126,342	129,765
Montana	Flathead	62,377	64,556	67,818	36,362	40,871
Montana	Lincoln	65,283	55,155	81,581	38,577	27,781
Montana	Sanders	40,645	39,732	52,406	21,399	15,992
Total		500,327	503,163	543,469	366,766	350,055

[a]All volumes in million board feet (MBF) (Scribner)

Forest Residuals

Residuals developed in the forest mirror the trends for Sawmill Residuals. Although inherent variation in Forest Residuals generation can be influenced by the logging sector's ability to access harvest sites, in the Libby BDO Zone it is relatively small and is proxied here by timber harvest. Forest Residuals are the direct result of timber harvesting and likewise saw decreases between 2016 and 2020. In addition to the close associations between timber harvest, residual production, and demand for structural lumber, a recent article in the *Daily Inter Lake* (Kalispell, Montana) reports that increased harvesting activity in the Zone will take place by the end of 2022[30]. This is the result of a multi-year project aimed at reducing wildfire risk through the reduction of hazardous fuels in forests. To accomplish this work, over $19 million has been earmarked for thinning and planting on 7,200 acres of the Kootenai National Forest in Lincoln County, Montana, through the federal Infrastructure Investment and Jobs Act[31]. *The Daily Inter Lake* also reports that additional benefits of this funding will include a supply of logs (associated Forest Residuals and Pulpwood) for the region's wood products industry.

In addition, state and local agencies are seeking ways to thin the forestland around the region's scattered communities to reduce the urban wildfire interface, which will generate additional forest residues in the Zone[32].

2.4 Suppliers

Sawmill Residuals

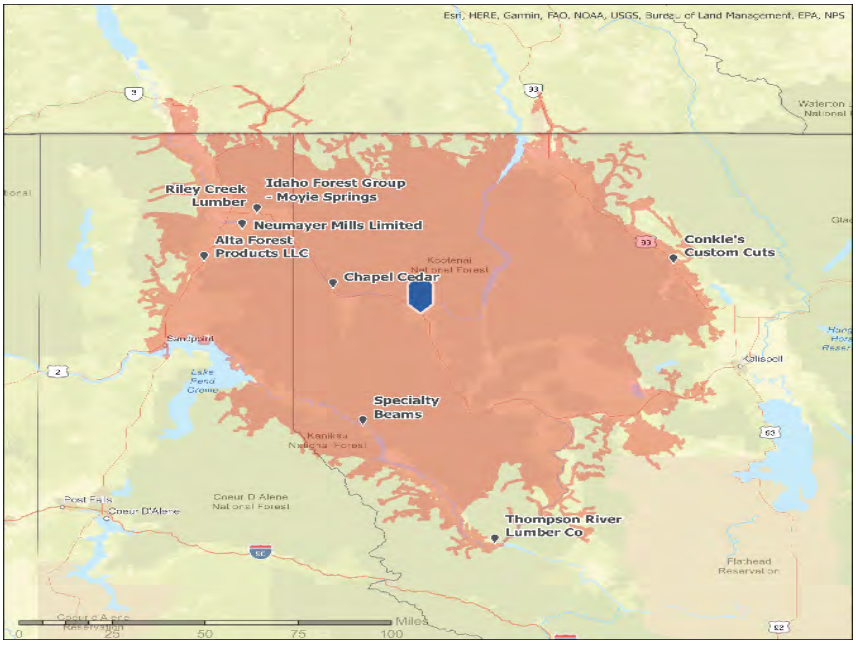
Eight sawmills are located in the Libby BDO Zone (Map 3, Table C). Two additional mills owned by Stimson Lumber are located just outside the Zone but are included because they have the capacity to process wood taken in the Zone. Data from 2018[33], the most recent available, reports a total mill residue generation of 45.8 MMCF, of which 43 MMCF was utilized as furnish for pulp and for medium-density fiberboard manufacturing. Much smaller proportions were used internally by mills

[29] http://www.bber.umt.edu/fir/s_mt.asp, n.d.
[30] https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.
[31] https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.
[32] Verbal communication with foresters, land managers, and loggers in the Libby Supply Basin. April–May 2022.
[33] Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.

or schools for energy (1.5 MMCF), or went to livestock bedding and mulch (1.2 MMCF)[34].

Through correspondence with industry experts in the Libby area, it is estimated that 95+% of the Residuals produced by these mills are currently accounted for in the marketplace[35]. Due to trade confidentiality in this tight market, sawmills did not disclose quantities or prices. Anecdotal evidence suggests that additional market outlets for residuals could create healthy competition and bolster forest harvesting activity. Currently, a few key players absorb the majority of Sawmill Residuals in the Libby BDO Zone. A more stable strategy for obtaining woody feedstock would be centered on the currently underutilized Forest Residuals and Pulpwood.

Map 3: Sawmills in the Libby BDO Zone



[34] Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.
[35] Correspondence with local stakeholders in the Libby, Montana, Supply Zone. May 2022.

Table C: Mill Names, Addresses, County of Operation, and Wood Consumption

Sr No.	Sawmill	Address	City	Zip	FIPS State	State	FIPS County	County	Annual timber use Size Category
1	Alta Forest Products LLC	Old Highway 2	Naples	83847	16	Idaho	21	Boundary	5000 MCF or more
2	Chapel Cedar	305 Chapel Flats Rd.	Troy	59935-0315	30	Montana	53	Lincoln	500 TO 999 MCF
3	Conkle's Custom Cuts	P.O. Box 152	Olney	59927	30	Montana	29	Flathead	<250 MCF
4	Idaho Forest Group - Moyie Springs	3082 East Roosevelt Rd	Moyie Springs	83845	16	Idaho	21	Boundary	5000 MCF or more
5	Neumayer Mills Limited	Rt 1 Box 519	Bonners Ferry	83805	16	Idaho	21	Boundary	<250 MCF
6	Riley Creek Lumber	30 Riley Creek Park Dr.	Laclede	83841	16	Idaho	17	Bonner	
7	Specialty Beams	774 Triangle Dr.	Ponderay	83852	16	Idaho	17	Bonner	<250 MCF
8	Thompson River Lumber Co	5332 Hwy 200	Thompson Falls	59873	30	Montana	89	Sanders	1000 TO 4999 MCF
9	Stimson Lumber	12 Old Priest River Rd,	Priest River	83856	16	Idaho	17	Bonner	
10	Stimson Lumber	733 10th St,	Plummer	83851	16	Idaho	09	Benewah	Hew saw processing small diameter logs

Forest Residuals

We identified 20 logging companies registered in the Libby BDO Zone that could potentially process Forest Residuals and Pulpwood from their harvesting operations to supply a project in Libby, Montana (Table D). Because this list is not comprehensive, the first two entries in Table D are logging organizations that can address questions regarding this industry segment. Very few logging companies currently process Forest Residuals[36]. Our experience suggests that with additional demand for Forest Residuals and Pulpwood, logging companies will invest in processing equipment to handle that material. Table E shows the breakdown of Forest Residuals resulting from logging practices for the six Libby BDO Zone counties. Roundwood Pulpwood production is shown in Table F.

Table D: List of Companies with Harvesting Operations Registered in the Libby BDO Zone

Sr No.	Company Name	Website	Full Address	Distance From Libby (miles)
1	Mike Reynolds Logging	www.mikereynoldslogging.com	350 Peterson Rd, Priest River, Idaho, 83856, United States	179
2	Dennison Logging	www.dennisonlogging.com	62 Sunrise Dr, Kalispell, Montana, 59901, United States	88

[36] Verbal correspondence with local logger in the Supply Basin indicates a very small fraction currently operates an in-woods chipper or grinder. May 2022.

3	Ureco	urecoconstruction.com	1947 9th St W, Columbia Falls, Montana, 59912, United States	92
4	Timberlake Builders	www.skookumtimber.com	144 2nd St E, Ste 102, Whitefish, Montana, 59937, United States	106
5	TH Logging	www.thlogging.com	PO Box 273, Arlee, Montana, 59821, United States	195
6	UTR Land Management Gallery	utrlandmgnt.com	1303 Deep Creek Loop, Naples, Idaho, 83847, United States	164
7	RJK LOGGING	eurekadsl.net	176 Black Dog Cv, Eureka, Montana, 59917, United States	61
8	S BLOOD	mail.sandpoint.net	422 Elm Ave, Ponderay, Idaho, 83852, United States	68
9	Trees R Us	www.idahowholesaletrees.com	511398 Hwy 95, Bonners Ferry, Idaho, 83805, United States	82
10	JEFF GAMET LOGGING	prorate48.com	6277 Mt Hwy 83, Condon, Montana, 59826, United States	48
11	Shawn Montee Timber	www.shawnmonteetimberco.com	PO Box 2028, Coeur D Alene, Idaho, 83816, United States	110
12	Wild Montana Wood	www.wildmontanawood.com	4440 Farm To Market Rd, Kalispell, Montana, 59901, United States	129
13	RL Timber	www.rltimber.com	524 Callen Crabb Rd, Sagle, Idaho, 83860, United States	94
14	Next Generation Logging	www.nextgenlogging.com	17790 N Jeslon Ct, Hayden, Idaho, 83835, United States	93
15	D & s Logworks	www.dnslogworks.com	1025 Mccaffery Rd, Bigfork, Montana, 59911, United States	119
16	Mid-Mountain Land & Timber	www.midmountainland.com	PO Box 986, Hayden, Idaho, 83835, United States	107

Table E: Forest Residuals from Logging by County in the Libby BDO Zone

Forest Residuals					
State	**County**	**Logging Residuals in County (Cubic Feet)**	**County Proportions**	**Logging Residuals in Supply Basin (Cubic feet)**	**Logging Residuals in Supply Basin (Dry Tons)**
Idaho	Shoshone	6,747,831	27%	1,840,764	
Idaho	Boundary	2,242,407	50%	1,138,930	
Idaho	Bonner	7,573,109	1%	42,839	
Montana	Sanders	3,484,621	13%	472,301	
Montana	Lincoln	5,015,172	87%	4,401,574	
Montana	Flathead	3,939,139	30%	1,206,521	
Total		**29,002,281**		**9,102,928**	
CF (GT/MCF)		**30**		**30**	
Green tons		**870,068**		**273,088**	**136,543**

Pulpwood

Pulpwood production is most prevalent in Shoshone County, only one quarter of which is in the Libby BDO Zone. Sanders County contributes the least Pulpwood in the Zone. Since a major facility sourcing Pulpwood closed in 2010, production in the Zone is now constrained by available market outlets. We assume a moisture content for the Pulpwood of 50% at the time it is cut. It is not uncommon for buyers to specify a moisture content of roughly 35% for feedstock purposes. This is achieved through air drying (the bolts are allowed to reduce moisture by sitting on-site for a period of time depending on air temperature and relative humidity).

Table F: Roundwood Pulpwood by County in the Libby BDO Zone

State	County	Type	Pulpwood (Cubic Feet)	County Proportions	Pulp in Supply Basin (Cubic Feet)
Idaho	Shoshone	Pulpwood	7,480,468	27%	2,040,623
Idaho	Boundary	Pulpwood	1,008,300	50%	512,120
Idaho	Bonner	Pulpwood	1,501,708	1%	8,494
Montana	Sanders	Pulpwood	222,222	13%	30,119
Montana	Lincoln	Pulpwood	-	87%	-
Montana	Flathead	Pulpwood	222,222	30%	68,064.55
Total			10,434,922.96		2,659,423.12
CF (gt/MCF)			25		25
Green tons			260,873.07		66,485.58

3. Demand

3.1 Competitors

The area's largest previous consumer of roundwood Pulpwood closed in 2010, causing decreased roundwood Pulpwood harvesting. A roundwood chipping facility that began operation in Bonner, Montana, in 2012 has been through a cycle of periodic closures and operation. The chipping mill relies on material produced by wildfire risk reduction and forest health initiatives and provides a large medium-density fiberboard (MDF) mill with their feedstock. Another chipping operation is located on the site of the MDF mill and feeds that mill exclusively.

Three major categories of facilities consume primarily Sawmill Residuals in the Libby BDO Zone with only minor and inconsistent Forest Residuals: heating facilities, MDF production facilities, and pellet mills facilities. Thirty-two facilities compete for woody residues within the 160-mile drive distance Competition Zone. Key competitors to an incoming woody biomass operation include MDF production, two firewood/fuelwood processors, a plywood/veneer mill, and two pellet mills. Other users include two schools with small wood chip heating systems. Methodology for estimating competitor woody biomass consumption is provided in Appendix C.

Competitors located at longer distances from the Libby BDO Zone source additional feedstock from areas outside the Zone. We estimate that between 400,000 and 450,000 gt/yr of Sawmill Residuals are currently being used by existing facilities.

Map 4: Competitors within 160-Mile Drive Distance

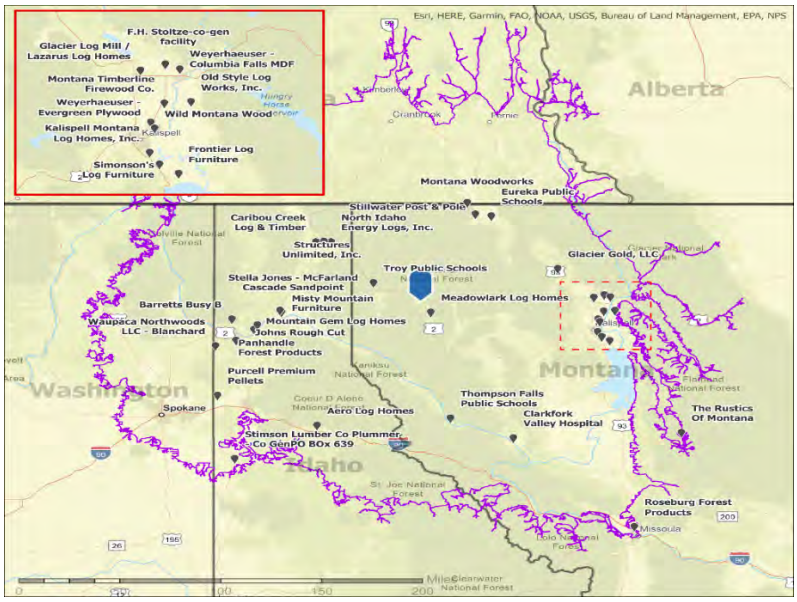


Table G provides a listing of woody biomass competitors within a 160-mile drive distance of Libby. Facility locations and annual wood use characteristics are shown.

Table G: Competitors within 160-Mile Drive Distance

Sr No.	Facility Name	Facility type	Address	City	State	County	Annual Timber Use Size Category
1	Aero Log Homes	log home	41657 Riverview Drive	Kingston	Idaho	Shoshone	<250 MCF
2	Barretts Busy B	cedar products	109 Barrett Mill Road	Priest River	Idaho	Bonner	<250 MCF
3	Caribou Creek Log & Timber	log home	HCR 85 Box 3	Bonners Ferry	Idaho	Boundary	<250 MCF
4	F.H. Stoltze-co-gen facility	biomass/energy	600 Half Moon Road	Columbia Falls	Montana	Flathead	No roundwood
5	Frontier Log Furniture	log furniture	815 Highway 82	Somers	Montana	Flathead	<250 MCF
6	Glacier Gold, LLC	bark products	255 Good Creek Road	Olney	Montana	Flathead	No roundwood
7	Glacier Log Mill / Lazarus Log Homes	log home	5088 Whitefish Stage	Whitefish	Montana	Flathead	<250 MCF
8	Johns Rough Cut	log furniture	125 Blue Spruce Lane	Laclede	Idaho	Bonner	<250 MCF
9	Kalispell Montana Log Homes, Inc.	log home	3250 US Highway 93 South	Kalispell	Montana	Flathead	<250 MCF
10	Meadowlark Log Homes	log home	50 Meadowlark Lane	Libby	Montana	Lincoln	<250 MCF
11	Misty Mountain Furniture	log furniture	502 Cedar Street Station	Sandpoint	Idaho	Bonner	<250 MCF
12	Montana Timberline Firewood Co.	firewood (fuelwood)	1960 Helena Flats Road	Kalispell	Montana	Flathead	<250 MCF

13	Montana Woodworks	log furniture	250 Whitetail Drive	Rexford	Montana	Lincoln	<250 MCF
14	Mountain Gem Log Homes	log home	16793 Highway 2 West	Laclede	Idaho	Bonner	<250 MCF
15	North Idaho Energy Logs, Inc.	fuel pellet/presto logs	1270 Roosevelt Road	Moyie Springs	Idaho	Boundary	No roundwood
16	Old Style Log Works, Inc.	log home	1790 Hightway 206	Columbia Falls	Montana	Flathead	<250 MCF
17	Panhandle Forest Products	post/pole/piling	Hoodoo Mountain Road	Priest River	Idaho	Bonner	250 TO 499 MCF
18	Purcell Premium Pellets	fuel pellet/presto logs	16620 W Prairie Avenue	Hauser	Idaho	Kootenai	No roundwood
19	Roseburg Forest Products	particleboard/MDF/hardboard/composite panel	3300 Raser Drive	Missoula	Montana	Missoula	No roundwood
20	Simonson's Log Furniture	log furniture	4124 Hwy 93 South	Kalispell	Montana	Flathead	<250 MCF
21	Stella Jones - McFarland Cascade Sandpoint	post/pole/piling	975 Baldy Mountain Road	Sandpoint	Idaho	Bonner	250–499 MCF
22	Stillwater Post & Pole	post/pole/piling	335 Country Lane	Olney	Montana	Flathead	250–499 MCF
23	Stimson Lumber Co Plummer - Co GenPO BOX 639	biomass/energy	733 10th Street	Plummer	Idaho	Benewah	No roundwood
24	Structures Unlimited, Inc.	log home	P.O. Box 613	Bonners Ferry	Idaho	Boundary	<250 MCF
25	The Rustics of Montana	log home	HC 83	Condon	Montana	Missoula	<250 MCF
26	Waupaca Northwoods LLC - Blanchard	bark products	Hwy 41 Mile Marker 30	Blanchard	Idaho	Bonner	No roundwood
27	Weyerhaeuser - Columbia Falls MDF	particleboard/MDF/hardboard/composite panel	500 12th Avenue West	Columbia Falls	Montana	Flathead	No roundwood
28	Weyerhaeuser - Evergreen Plywood	plywood/veneer mill	75 Sunset Drive	Kalispell	Montana	Flathead	5000 MCF or more
29	Wild Montana Wood	firewood (fuelwood)	4440 Farm to Market Road	Kalispell	Montana	Flathead	<250 MCF

3.2 Future Competitors

Future competition for any area is difficult to predict. We identified one additional business that was proposing to operate in the Libby BDO Zone pending a secured line of credit for the out-of-state Proponent[37]. The firm would have developed a medium-density fiberboard plant in Libby in a structure on port authority property commonly referred to as the Stinger building.[38] Data on the type of residues this plant would have used are not available. It appears this particular endeavor is unlikely to be realized, but future efforts to bring such a facility are likely to continue and should be assessed for the most recent developments.

One chipping operation established in 2012 has experienced sporadic production cycles. When running, the mill utilizes Forest Residuals in volumes that are insignificant compared to what is available.

[37] https://dailyinterlake.com/news/2021/jul/13/hurdles-remain-bring-mdf-factory-Libby/?msclkid=97a7422fd14311ec82b0e7beb225e6ff.
[38] https://dailyinterlake.com/news/2022/apr/23/193m-pegged-wildfire-mitigation-kootenai-forest/.

4. Pricing

4.1 Current Pricing

Specific price points for woody biomass in the Libby BDO Zone were not accessible. Therefore, the following values represent ranges that can vary +/- several dollars. The values were corroborated by review from industry experts in the Zone[39].

The current delivered price range estimates (in US dollars) by feedstock type (per green ton) are:

Forest Residuals: $30 to $35
Pulpwood: $25 to $35
Sawmill Residuals (by category):

- Bark: $25 to $30
- Sawdust: $15 to $20
- Shavings: $32 to $37.50
- Softwood Chip: $50 to $55

4.2 Historical Pricing

Historical pricing trends for all residual types are not publicly available, and manufacturing facilities in the area were not willing to disclose them. Therefore, our analysis focuses on production and current pricing estimates. Conversations with industry experts in the Libby BDO Zone suggest that wood pricing trends in the past five years are similar to those in today's markets. Thus, we assume that historical residue prices have not deviated radically from those estimated in today's markets.

Year-to-year variation in Sawmill Residual generation is the result of mill production and lumber markets. To estimate Sawmill Residual generation variation, we use Roundwood as a proxy. Between 2016 and 2021, an overall decrease in timber harvest was observed across the six counties in the Libby BDO zone. The decreased timber harvest means fewer logs were available for lumber and veneer manufacturing. Decreased production of those wood products means fewer Sawmill Residuals are produced from the initial breakdown of logs into lumber. We expect this trend to reverse in the coming years with housing starts and financial commitments to forest stand improvement work aimed at forest fires fuels reduction.

5. Transportation

Sawmill Residuals and Forest Residuals are transported primarily in open-top or traditional van trailers. Live-bottom trailers are available but are not the norm. Conversations with local stakeholders revealed that most Sawmill and Forest Residuals are currently transported with standard open-top trailers. New bioprocessing facilities may have to design around the open-top trailer infrastructure or be prepared to invest in the acquisition of more specialized equipment. Pulpwood is transported in a similar fashion to sawlogs.

Sawmill Residuals

Transportation of Sawmill Residuals is most commonly done by sawmills, which own and operate trucks and trailers used for delivery. When sawmills do not have enough equipment for deliveries, transportation is outsourced to third-party hauling companies. We identified 21 trucking companies operating in the Libby BDO Zone that could be potentially used for Sawmill Residual transportation (See Appendix D).

[39] Correspondence with local stakeholders in the Libby, Montana, Supply Zone. May 2022.

Forest Residuals

Equipment used to transport Forest Residuals is owned and operated either by logging/harvesting companies or by third-party trucking companies. We identified 20 logging/harvesting companies (Table 5) and 21 trucking companies (Appendix D) operating in the Libby BDO Zone.

Pulpwood

Equipment used to transport Pulpwood is owned and operated either by logging/harvesting companies or by third-party trucking companies. These companies are listed in Table 5 and Appendix D.

6. Infrastructure

6.1. Roads

Lincoln County is distant from major metropolitan areas. There is rail service but no access to an interstate highway. The road infrastructure consists of a network of county roads, city streets, state highways, and Forest Service roads. US Highway 2 connects Libby and Troy with Kalispell in Montana and with Idaho. Highway 37 connects Libby to Eureka, Whitefish, and Canada. Most of the roads are paved or chip-sealed. Twelve bridges are maintained year-round within the Troy District, with repaving and repair in the summer months and plowing during the winter season[40].

The majority of Lincoln County roads are old. The county has not built new roads since 1993. Instead, roads rely on consistent maintenance to remain operable and safe. To this end, they are surface coated every five years. The relatively small population in the Libby BDO Zone means that traffic congestion is generally not a problem, although periodic congestion on Highway 93 results in temporary backups and delays.

Because of the Kootenai National Forest there are thousands of miles of Forest Service roads within Lincoln County. These roads are subject to seasonal closures and can be unreliable.
The combined road systems in the region have accommodated the active forest products and logging industry for decades. Distance from a forest harvesting site to a road and the slope encountered on those roads are factors in financial and logistic feasibility for Forest Residuals supply[41]. In his report for the Forestry Assistance Bureau of the Montana Department of Natural Resources and Conservation, Morgan states that "about 20% (148 MDT [million dry tons]) of live tree woody biomass on timberlands in Montana is located within 1,000 feet (ft.) of a road, while about 40% (295 MDT) is located more than 1 mile from a road (Table 3). Nearly 65% (468 MDT) of the live tree biomass on Montana timberlands is located on land with slopes of less than 40%, and 29% (210 MDT) is located on land with less than 20% slope. These figures suggest that substantial volumes of live tree biomass are accessible to ground-based harvesting systems, which are substantially less costly than cable or helicopter logging, and likely would not require new forest roads to be built"[42].

6.2. Availability of Labor

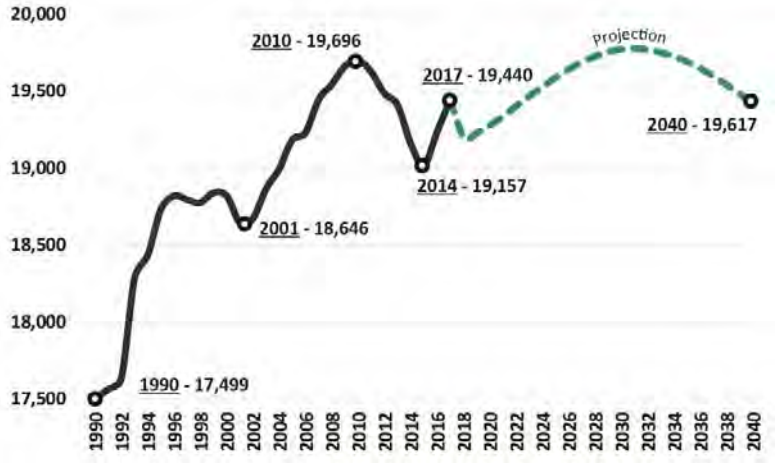
The forest products industry in Montana has employed as many as 6,973 people and contributed $869 million to the state's economy. Historically, labor participation rates around Libby, Montana, have been nearly 80%[43].

[40] Lincoln County Growth Policy 2019 Update. A report prepared for Board of County Commissioners Lincoln County, Montana by Land Solutions, LLC and KMR Consulting, LLC. Adopted December 4, 2019.

[41] Correspondence with local stakeholders in the Libby, Montana, Supply Zone. May 2022.
[42] Steven W. Hayes, Lucas Townsend, Thale Dillon, Todd A. Morgan, and John D. Shaw. 2018. Montana's Forest Products Industry and Timber Harvest. USDA Forest Service, Mountain Research Station, Resource Bulletin RMRS-RB-35. October 2021.
[43] A Review of Economic Conditions in Lincoln County, Montana by Clint Oster, Lincoln County Port Authority, October 29, 2017.

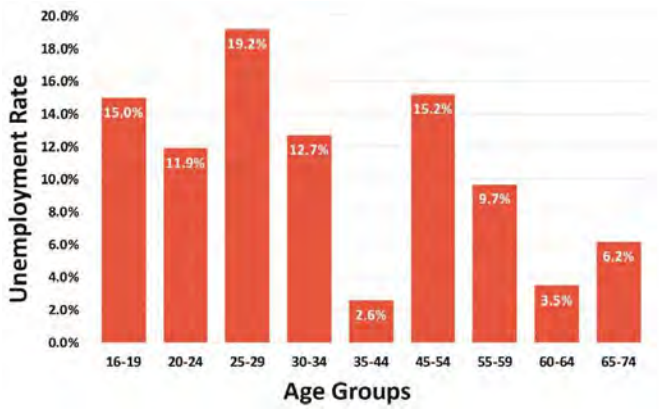
Lincoln County's population has grown steadily since 1990 with minor fluctuations,[44] and it is projected to increase slightly in the current decade and level off by 2030, as outlined in Figure 5 (the Y-axis of the figure is in thousands of people, and the X-axis denotes years)[45].

Figure 5: Population Characteristics of Lincoln County, 1990–2040



We assume a stable workforce in the Libby area given current population growth, high labor participation rates, and project a slight increase in population. Combining growth with unemployment data by age group (Figure 6), we expect ample workers potentially seeking employment in the area.

Figure 6: Population Ages and Rates of Unemployment in Lincoln County



7. Policy

7.1. Local, Federal & National Laws, Regulations and Permitting Pertaining to Biomass

Historically, Lincoln County's economy has been anchored by natural resource extraction, primarily mining and the harvesting and manufacturing of forest products. Policy governing these activities are well established. No local, state, or federal laws or regulations pertaining to biomass were identified. A new wood utilization facility would be subject to current regulations governing existing wood-using entities. Prospective businesses looking to site in the Libby BDO Zone are advised

[44] Lincoln County Growth Policy 2019 Update. A report prepared for Board of County Commissioners Lincoln County, Montana by Land Solutions, LLC and KMR Consulting, LLC. Adopted December 4, 2019.
[45] Lincoln County Growth Policy 2019 Update. A report prepared for Board of County Commissioners Lincoln County, Montana by Land Solutions, LLC and KMR Consulting, LLC. Adopted December 4, 2019.

to contact the Department of Environmental Quality and the Industry Development Program-Montana Office of Tourism and Business Development for information regarding air quality and other aspects of potential impacts to the environment.

APPENDIX C: COMPETITION FEEDSTOCK CONSUMPTION

Note: All estimates were obtained from the most recently available data summary (2009) and, with the exception of biomass facilities and a proposed new medium-density fiberboard (MDF) facility, are credited to T. Morgan[46].

1. FACILITY HEATING COMPETITION ESTIMATION

The 2009 data provides a sense of consumption. Together, the 11 Fuels for Schools facilities can consume approximately 8,000 bone dry ton (DT) of Montana woody biomass (10,725 gt/yr at 35% moisture content)[47].

2. PELLET MILL COMPETITION ESTIMATION

The 2009 data provides a sense of consumption. Each pellet plant uses 20,000 to 40,000 DT annually (27,000–54,000 gt/yr at 35% moisture content)[48].

3. BIOMASS FACILITY'S COMPETITION ESTIMATION

Biomass Power Competition	Address	Distance from Libby, MT (miles)	Intake Capacity (gt/yr)
Stoltze CoGen1	Flathead, MT (3MW)	106	30,000
Plummer Cogen	Benewah County (5.8MW)	160	58,000
Total Biomass Power Competition			88,000

4. MDF FACILITIES COMPETITION ESTIMATION

The major MDF plant operating in the Libby BDO Zone uses an estimated 200,000 to 400,000 DT annually (270,000–540,000 gt/yr at 35% moisture content)[49].

[46] T. Morgan. 2009. An Assessment of Forest-based Woody Biomass Supply and Use in Montana. A report prepared for Forestry Assistance Bureau Forestry Division Montana Department of Natural Resources and Conservation Missoula, Montana.
[47] T. Morgan. 2009. An Assessment of Forest-based Woody Biomass Supply and Use in Montana. A report prepared for Forestry Assistance Bureau Forestry Division Montana Department of Natural Resources and Conservation Missoula, Montana.

[48]T. Morgan. 2009. An Assessment of Forest-based Woody Biomass Supply and Use in Montana. A report prepared for Forestry Assistance Bureau Forestry Division Montana Department of Natural Resources and Conservation Missoula, Montana.

[49] Anonymous. Verbal communication. May 2022.

Assuming a new MDF facility is eventually sited, its annual consumption would be estimated at 100,000 DT (135,000 gt/yr at moisture content 35%)[50].

[50]Anonymous. Verbal communication. May 2022.

APPENDIX D: TRUCKING COMPANIES OPERATING IN THE LIBBY BDO ZONE

Sr No.	Company Name	Website	Full Address	Distance From Libby (miles)
1	Jones Brothers Trucking	www.jonesbrotherstrucking.com	6681 Commercial Ln, Missoula, Montana, 59808, United States	184
2	Davis Transport	www.davistransport.com	216 Trade St, Missoula, Montana, 59808, United States	189
3	Western Automotive Transport	www.westernautomotivetransport.com	2341 US Highway 93 S, Kalispell, Montana, 59901, United States	92
4	Savasort	www.savasort.com	300 Windmill Dr, Ste B, Columbia Falls, Montana, 59912, United States	101
5	Three Jokers	www.threejokersinc.com	59494 S Hwy 97, Saint Maries, Idaho, 83861, United States	173
6	High Country Carriers	www.highcountrycarriers.com	PO Box 124, Arlee, Montana, 59821, United States	165
7	PALMER EXPRESS	www.palmerexpress.com	1726 Peggio Ln 3, Missoula, Montana, 59802, United States	192
8	TeCe Trucking	www.tecetrucking.com	8686 Aluminium Dr, Missoula, Montana, 59808, United States	188
9	H&H Express	www.hhexpress.net	PO Box 709, Rathdrum, Idaho, 83858, United States	124
10	Northwest Pony Express	www.nwponyexpress.com	415 Sherman Ave, Coeur D Alene, Idaho, 83814, United States	129
11	J. Gelormino	www.jgelorminoinc.com	95 Park Ave, Kalispell, Montana, 59901, United States	91
12	Second Chances Transport	www.secondchancestransport.com	49 Klister Ln, Trout Creek, Montana, 59874, United States	76
13	Eby Transport	www.ebytransport.com	1348 W Hayden Ave, Hayden, Idaho, 83835, United States	124
14	Royal Trucking	www.royaltrucking.us/	9000 Cartage Road, Missoula, Montana, 59808, United States	182
15	Wilson Logistics	www.wilsonlogistics.com/	9730 Derby Dr, Missoula, Montana, 59808, United States	183
16	John Jump Trucking, Inc.	www.johnjumptrucking.com/	2780 US Hwy 2 E Kalispell, Montana, 59901, United States	94
17	Lj Logistics LLC	No Website	1718 Cedar St Sandpoint, Idaho, 83864-2045, United States	85
18	EBY Transport LLC	No Website	1348 W Hayden Ave Hayden, Idaho, 83835-9756, United States	124
19	Wink, Inc.	www.winkincproductions.com	493 Scenic Dr Bonners Ferry, Idaho, 83805-7039, United States	54
20	Shane Campbell Trucking	No Website	2336 Poirier Rd Blanchard, Idaho, 83804-6024, United States	127
21	Bill Farrell Trucking	No Website	200 Cedar St Sandpoint, Idaho, 83864, United States	84

APPENDIX E: INFRASTRUCTURE

Economic Conditions in Lincoln County, Montana[51]

Age

Lincoln County had a much higher median age than either Montana or the United States in 2015 and its median age has increased much faster.

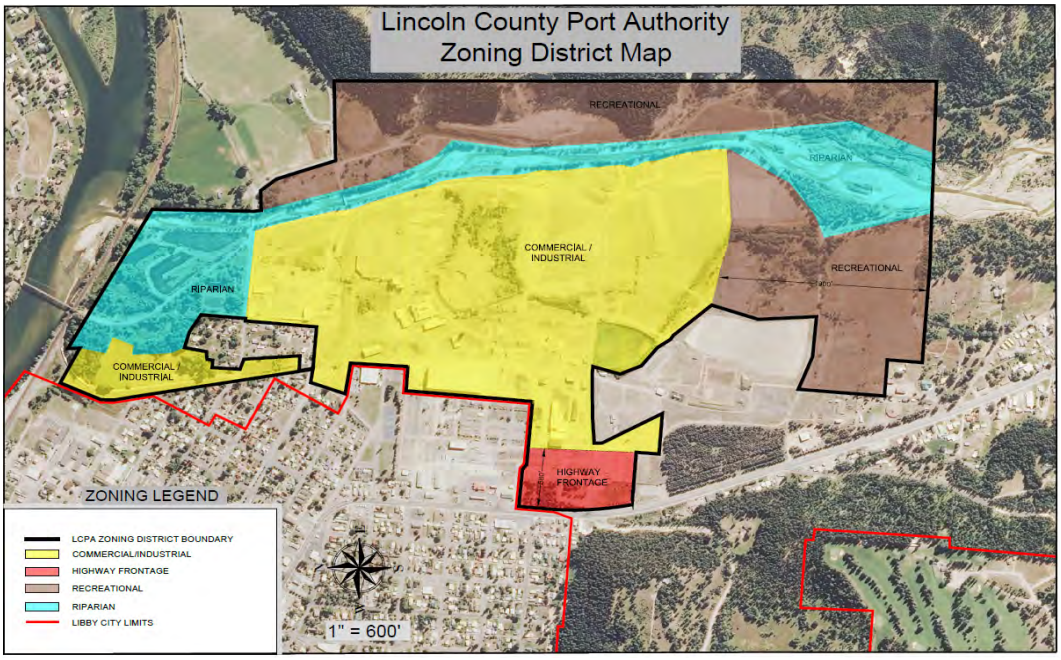
Education

The education level of the population age 25 and older is markedly different for Lincoln County than for Montana and the United States. A much smaller share of Lincoln County's population has a bachelor's degree or a graduate or professional degree, and a larger share of the population has a high school diploma with some college or an associate's degree. One explanation for these patterns is that fewer Lincoln County residents pursue a bachelor's or a graduate degree. Another explanation is that people with advanced degrees are more likely to leave Lincoln County for better job opportunities elsewhere.

Employment

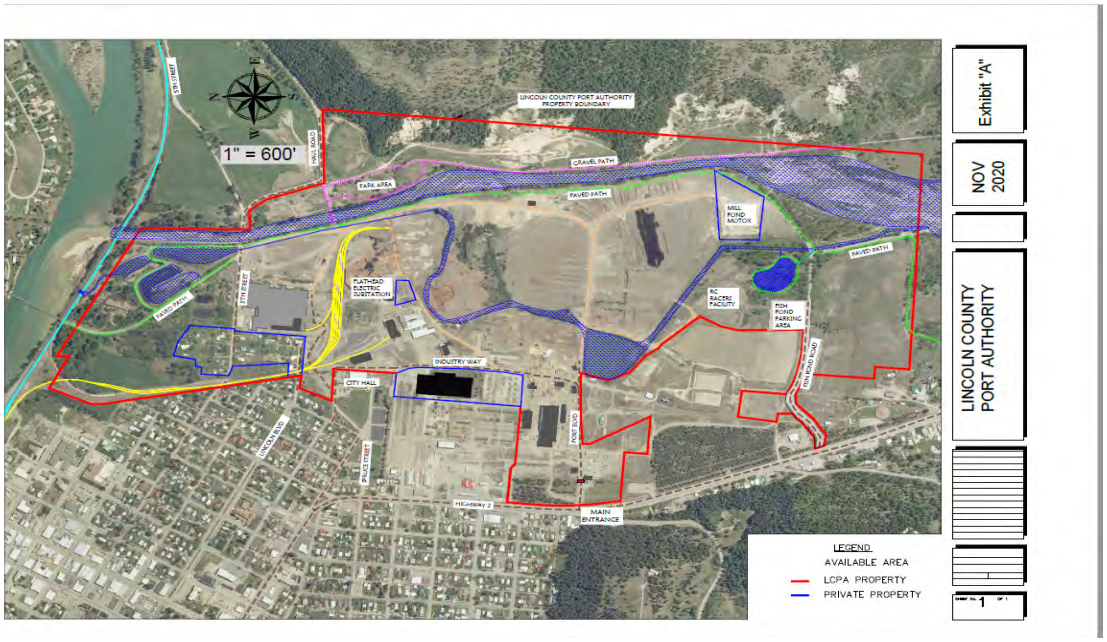
The labor force participation rate is the percentage of the population that is either employed or seeking employment. In 2015, the labor force participation rate for Lincoln County was 65 percent (versus 78 percent for Montana and 77 percent for the United States). A lack of employment opportunities in Lincoln County may discourage a higher share of the population from continuing to seek employment.

MAP 1: LINCOLN COUNTY ZONING MAP



[51] https://lincolncountyportauthority.com/.

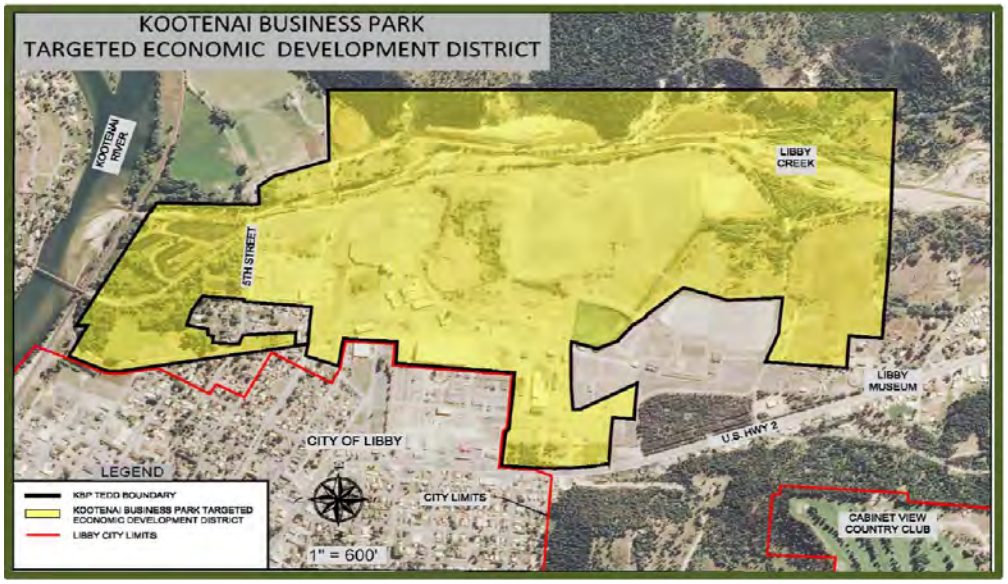
MAP 2: VICINITY TO PORT



Kootenai Business Park

The Kootenai Business Park is in the Libby BDO Zone and has all the infrastructure required. It encompasses an area of approximately 400 acres east and southeast of the Libby, Montana, municipal limits, on the east side of US Highway 2, off to Port Boulevard, East Lincoln Street, and East 5th Street, in portions of Sections 02, 03, 10, and 11, Township 30 North, Range 31 West, P.M.M., Lincoln County, Montana.

MAP 3: KOOTENAI BUSINESS PARK

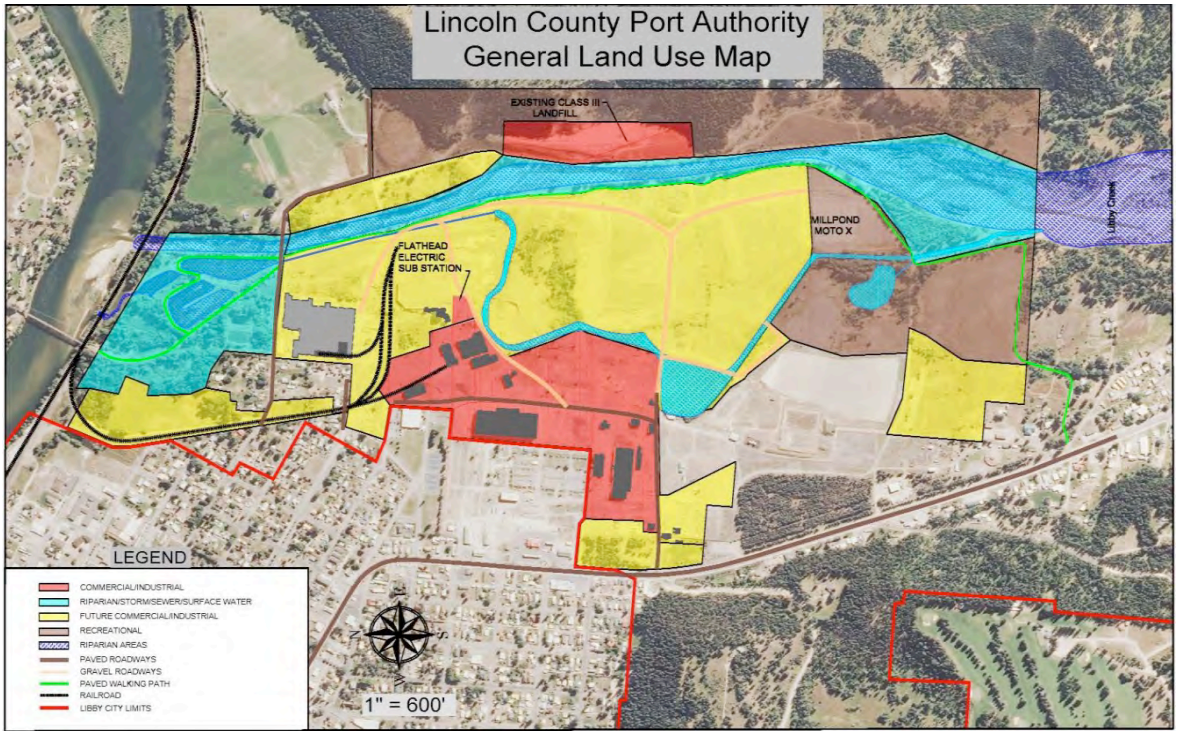


Existing Land Use

Current land use on the site includes wood product companies, remediations contractors, a heavy construction equipment company, a 100,000 square foot vacant industrial/warehouse structure built in 2011, derelict historic structures, a landfill for wood products waste generated on-site, a fishing pond, and a motocross track.

Land Use Map

MAP 4: LAND USE MAP



Transportation Infrastructure

Roads

The road network within the 400-acre Kootenai Business Park consists of both paved and gravel roads that have experienced a high volume of truck traffic. Historically they served heavily loaded logging trucks associated with the lumber mill and they currently serve truck traffic generated by SK Finger Joint, River Country Wood, Environmental Protection Agency site management teams, Thompson Contracting, and the Lincoln County Road Department. The heavy truck traffic creates a need for substantial maintenance, but repairs have been deficient. The paved sections do not conform to current Lincoln County Road standards. The pavement does not efficiently drain stormwater or provide an adequate driving surface for loaded tractor-trailers. The gravel portions generate dust and are costly to maintain.

Rail

The Kootenai Business Park was once connected to the BNSF main rail line, allowing businesses in the park to send products across the country. However, the half-mile rail spur connecting the park is in poor condition and presently unusable.

Water Rights and Delivery System

Water rights from Libby Creek provide for total available usage of 12,322-acre-feet per year or 11 million gallons per day. Libby Creek is an alluvial stream with a wide footprint at the diversion source, and it often moves from one braid to another; ongoing manual creek alteration is required to keep the water flowing at an adequate level on the Kootenai Business Park property. Water from the creek enters the property at the south end. A headgate structure can be used to allow flow into a channel to a storage pond. Excess flow can be directed into a different channel at the head gate

structure and back to Libby Creek. Some annual maintenance is required at this outtake system. Excavator work is needed before high water to prevent major damage to the dike and overflow system.

Sewage

A separate sewage collection and treatment system serves the Kootenai Business Park. Service is provided through a network of four-, six-, and eight-inch sewer mains. An inspection of several manholes indicates they are in fair condition. The pipe network served the Stimson Mill and does not follow a defined grid.

Sewage Treatment

Treatment is provided by two facultative lagoons. Flows to the lagoons are from a small lift station located on Port Authority lands across Fifth Street. Inter-pond piping has not been maintained and is not operational. The treatment system was likely designed in the early 1970s when the Stimson Mill employed as many as 1300 workers (or about 400 employees per shift). Based on national averages for sewage contribution per employee, the lagoons have a treatment capacity of approximately 13,000 gallons per day. The treatment system is located in the 100-year flood plain.

Utilities

Electrical Distribution System

There are two primary electric feeds to the Kootenai Business Park. The first is a 34.5 KV line from the main Libby Substation located north of the Kootenai River. The second is a 2300 V system from US Highway 2, which feeds a portion of the site including the dispatch office, the maintenance and shop buildings, the fire hall, the pump station, and a portion of the Finger Joint building.

Natural Gas

The closest natural gas providers are in Bonner's Ferry, Idaho (52 miles west), or Kalispell, Montana (89 miles east). Alternative energy sources include fuel oil, wood products, solar, and wind.

Broadband Connectivity

There are no fiber optic feeds into the Kootenai Business Park. A commercial scale-up for connectivity requires the installation of communication infrastructure. Fiber optics running adjacent to the property on US Highway 2 allows access speeds of 1 gigabit per second.

APPENDIX F: LEGAL DISCLAIMER

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Appendix G. WTE Lifecycle Cost Estimates

General Assumptions	Unit	Value
Base Year	year	2026
First Year of Operation	year	2027
Study Period	years	20
Inflation	%	2%

Financing Assumptions	Unit	Value
Debt Ratio	%	100%
Equity Ratio	%	0%
Cost of Debt	%	3.5%
Cost of Equity	%	8.0%
Weighted Avg. Cost of Capital	%	3.5%

Capital Cost Assumptions	Unit	Value
Biomass Facility	2012$	$20,000,000
Mass Burn WTE	2022$/ton	$2,107
Transmission Upgrades Required	$	

Tonnage Assumptions	Unit	Value
Annual Wood Waste	tons/year	65,000
Annual MSW	tons/year	24,000

O&M Assumptions	Unit	Value
Wood waste hauling distance to site	miles	40
MSW hauling distance	miles	35
Wood waste hauling cost per ton (to faci	$/ton	$50.00
Wood waste hauling cost per ton (to lanc	$/ton	$6.23
MSW hauling cost	$/ton	$6.23
MSW Disposal Costs	$/ton	$42.59
Ash Disposal Costs	$/ton	$42.59

Facility O&M costs - Wood waste	Unit	Value
Labor	$/year	$915,219
Utilities	$/year	$37,645
Maintenance & Repair	$/year	$2,118,696
Consumables	$/year	$171,582
Supplies	$/year	
Fuel	$/year	$18,531
Professional Services & Eng.	$/year	$34,316
Insurance	$/year	$28,283
Administration	$/year	$45,761

Annualized Future Replacement Cost		
Wood Waste Facility	$/year	$19,798
MSW Facility	$/year	$79,453

Facility O&M costs - MSW	**Unit**	**Value**
Labor	$/year	$337,927
Utilities	$/year	$13,900
Maintenance & Repair	$/year	$782,288
Consumables	$/year	$63,353
Supplies	$/year	
Fuel	$/year	$6,842
Professional Services & Eng.	$/year	$12,671
Insurance	$/year	$56,461
Administration	$/year	$16,896

Material Byproducts	**Unit**	**Value**
Electricity Production - Wood Waste	kWh/ton	650
Electricity Production - MSW	kWh/ton	650
Parasitic Load	%	13%
Ash Generated - Wood Waste	%	5%
Ash Generated - MSW	%	28%
Initial Reject Rate - Wood Waste	%	0%
Initial Reject Rate - MSW	%	10%
Ferrous Metal Recovery - MSW	%	3.0%
Non-ferrous Metal Recovery - MSW	%	0.4%

Revenue Assumptions	**Unit**	**Value**
Electricity Buyback Rate	$/kWh	$0.03
Ferrous Metal Recovery	$/ton	$120
Nonferrous Metal Recovery	$/ton	$820

Source/Notes

Assumed overnight construction

Source/Notes

Assumed to be fully financed via municipal bond funding

Assumed based on municipal cost of financing in Montana for bonds maturing by 2040. https://www.mbis.co
Assumed

Source/Notes

Comparable facility - F. H. Stoltze Land & Lumber
Comparable facility on a cost per ton based on work for Hillsborough County, FL
TBD

Source/Notes

Assumed per email from Omar Al-Shafie 5/26/2026
Assumed per email from Omar Al-Shafie 5/26/2026

Source/Notes

Assumed per email from Omar Al-Shafie 5/26/2026
Assumed per email from Omar Al-Shafie 5/26/2026
Rough estimate per conversation w/Omar Al-Shafie and Harrison Dewhurst. Assumes County has to pay logge
Calculated based on 20 tons / truck transporting material 20 miles one-way @ 45 mph with a MPG of 2.5 gallo
Calculated based on 20 tons / truck transporting material 20 miles one-way @ 45 mph with a MPG of 2.5 gallo

Assumed based on average cost of disposal in Montana
Assumed to be consistent w/MSW disposal cost

Source/Notes

Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024 (0.1% of CAPEX). Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024 (5% of labor). Escalated to 2026$

Assumed 2% of CAPEX for reserves for replacement costs
Assumed 2% of CAPEX for reserves for replacement costs

Source/Notes
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024. Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024 (0.1% of CAPEX). Escalated to 2026$
Assumption based on Hillsborough new WTE facility from 2024 (5% of labor). Escalated to 2026$

Source/Notes
Based on industry averages - consistent w/estimates from F. H. Stoltze Land & Lumber
Based on industry averages - consistent w/estimates from F. H. Stoltze Land & Lumber
Assumption
Average between 3%-7%, per email from Omar Al-Shafie 5/26/2026
Average between 20%-35%, per email from Omar Al-Shafie 5/26/2026
Assumption
Assumption
Assumption based on estimate produced for Hillsborough County, FL

Source/Notes
Based on current LEC wholesale purchase price
Based on J.R. Advanced Recyclers scrap ferrous price (based on cars/trucks) . Accessed May 29, 2026. https:
Based on $0.41/lb from iScrap App for alumnimum cans in Montana. Accessed May 29, 2026. https://iscrapa

ns with 1 driver, fuel cost of $5.36, no profit markup and maintenance & consumable cost of $0.36/mi
ns with 1 driver, fuel cost of $5.36, no profit markup and maintenance & consumable cost of $0.36/mi

pp.com/yards/us-montana-great-falls-pacific-steel-recycling-great-falls/pricing/#google_vignette

		1 2026
Tonnage		
Wood waste		0
MSW		0
Rejected Material		
Wood waste		-
MSW		-
Ash Produced		
Wood waste		-
MSW		-
Metal Recovery		
Ferrous Metal Recovery		-
Non-ferrous Metal Recovery		-
Capital Cost		
Capital Cost - Equity		
Biomass Facility		-
MSW Facility		-
Electrical Upgrades		-
Cost of Debt	**Unit Costs**	
Biomass Facility	$28,282,664	-
MSW Facility	$56,460,595	-
Electrical Upgrades	-	-
Hauling & Disposal Costs		
Wood waste hauling cost (to facility)		-
Hauling & Disposal of Rejected Wood waste		-
Disposal of Rejected MSW		-
Disposal of Ash from Wood waste		-
Disposal of Ash from MSW		-
Facility O&M Costs		
Wood Waste Facility O&M		-
Labor		-
Utilities		-
Maintenance & Repair		-
Consumables		-

Supplies		-
Fuel		-
Professional Services & Eng.		-
Insurance		-
Administration		-
Annualized Future Replacement Costs		-
MSW Facility O&M		-
Labor		-
Utilities		-
Maintenance & Repair		-
Consumables		-
Supplies		-
Fuel		-
Professional Services & Eng.		-
Insurance		-
Administration		-
Annualized Future Replacement Costs		-

Electricity Generation		
Electricity Generated from Wood Waste	kWh	-
Electricity Generated from MSW	kWh	-
Electricity Revenues from Wood Waste	$	-
Electricity Revenues from MSW	$	-
Metal Recovery Revenue from Ferrous Material - MSW	$	-
Metal Recovery Revenue from Non-ferrous Material - MSW	$	-

NPV of Wood Waste Facility	
Capital Cost - Equity	-
Capital Cost - Debt	$27,326,245
O&M - Hauling to Facility	$54,067,817
O&M - Hauling & Disposal	-
O&M - Disposal of Ash Generated	$2,302,748
O&M - Facility Costs	$56,394,092
Revenue - Electricity Generated	-$18,345,210
Total Cost	**$121,745,692**
Levelized Cost per Ton	**$136.40**
Levelized Cost per Year	**$8,283,161**
Levelized Cost per Ton per Day	**$0.37**

NPV of MSW Facility

Capital Cost - Equity	-
Capital Cost - Debt	$54,551,299
O&M - Hauling & Disposal	$1,949,177
O&M - Disposal of Ash Generated	$765,221
O&M - Facility Costs	$22,788,179
Revenue - Electricity Generated	-$6,096,255
Revenue - Ferrous Metals	-$3,892,883
Revenue - Nonferrous Metals	-$1,178,645
Total Cost	**$68,886,094**
Levelized Cost per Ton	**$209.02**
Levelized Cost per Year	**$4,686,775**
Levelized Cost per Ton per Day	**$0.57**

1	*1*	*1*	*1*	*1*	*1*	*1*	*1*
2027	2028	2029	2030	2031	2032	2033	2034
65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
-	-	-	-	-	-	-	-
2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
3,250	3,250	3,250	3,250	3,250	3,250	3,250	3,250
1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080
1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950
86	86	86	86	86	86	86	86
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999
$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628
-	-	-	-	-	-	-	-
$3,315,000	$3,381,300	$3,448,926	$3,517,905	$3,588,263	$3,660,028	$3,733,228	$3,807,893
-	-	-	-	-	-	-	-
$119,508	$121,898	$124,336	$126,823	$129,359	$131,946	$134,585	$137,277
$141,186	$144,010	$146,890	$149,828	$152,824	$155,881	$158,998	$162,178
$46,917	$47,855	$48,813	$49,789	$50,785	$51,800	$52,836	$53,893
$3,457,628	$3,526,781	$3,597,316	$3,669,263	$3,742,648	$3,817,501	$3,893,851	$3,971,728
$933,524	$952,194	$971,238	$990,663	$1,010,476	$1,030,685	$1,051,299	$1,072,325
$38,398	$39,166	$39,949	$40,748	$41,563	$42,395	$43,242	$44,107
$2,161,070	$2,204,292	$2,248,378	$2,293,345	$2,339,212	$2,385,996	$2,433,716	$2,482,391
$175,014	$178,514	$182,084	$185,726	$189,441	$193,229	$197,094	$201,036

-	-	-	-	-	-	-	-
$18,901	$19,280	$19,665	$20,058	$20,460	$20,869	$21,286	$21,712
$35,003	$35,703	$36,417	$37,145	$37,888	$38,646	$39,419	$40,207
$28,848	$29,425	$30,014	$30,614	$31,226	$31,851	$32,488	$33,138
$46,676	$47,610	$48,562	$49,533	$50,524	$51,534	$52,565	$53,616
$20,194	$20,598	$21,010	$21,430	$21,858	$22,296	$22,742	$23,196
$1,397,186	$1,425,130	$1,453,633	$1,482,705	$1,512,359	$1,542,607	$1,573,459	$1,604,928
$344,686	$351,579	$358,611	$365,783	$373,099	$380,561	$388,172	$395,935
$14,178	$14,461	$14,751	$15,046	$15,346	$15,653	$15,966	$16,286
$797,934	$813,892	$830,170	$846,774	$863,709	$880,983	$898,603	$916,575
$64,620	$65,913	$67,231	$68,576	$69,947	$71,346	$72,773	$74,229
-	-	-	-	-	-	-	-
$6,979	$7,119	$7,261	$7,406	$7,554	$7,705	$7,860	$8,017
$12,924	$13,183	$13,446	$13,715	$13,989	$14,269	$14,555	$14,846
$57,590	$58,742	$59,916	$61,115	$62,337	$63,584	$64,855	$66,153
$17,234	$17,579	$17,931	$18,289	$18,655	$19,028	$19,409	$19,797
$81,042	$82,662	$84,316	$86,002	$87,722	$89,476	$91,266	$93,091

$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500
$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800
$1,124,780	$1,147,275	$1,170,221	$1,193,625	$1,217,498	$1,241,847	$1,266,684	$1,292,018
$373,773	$381,248	$388,873	$396,651	$404,584	$412,675	$420,929	$429,348
$238,680	$243,454	$248,323	$253,289	$258,355	$263,522	$268,792	$274,168
$72,265	$73,710	$75,184	$76,688	$78,222	$79,786	$81,382	$83,010

1	*1*	*1*	*1*	*1*	*1*	*1*	*1*
2035	2036	2037	2038	2039	2040	2041	2042
65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
-	-	-	-	-	-	-	-
2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
3,250	3,250	3,250	3,250	3,250	3,250	3,250	3,250
1,080	1,080	1,080	1,080	1,080	1,080	1,080	1,080
1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950
86	86	86	86	86	86	86	86
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999	$1,989,999
$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628	$3,972,628
-	-	-	-	-	-	-	-
$3,884,051	$3,961,732	$4,040,967	$4,121,786	$4,204,222	$4,288,306	$4,374,072	$4,461,554
-	-	-	-	-	-	-	-
$140,022	$142,823	$145,679	$148,593	$151,565	$154,596	$157,688	$160,842
$165,422	$168,730	$172,105	$175,547	$179,058	$182,639	$186,292	$190,018
$54,971	$56,070	$57,192	$58,336	$59,502	$60,692	$61,906	$63,144
$4,051,163	$4,132,186	$4,214,830	$4,299,126	$4,385,109	$4,472,811	$4,562,267	$4,653,512
$1,093,772	$1,115,647	$1,137,960	$1,160,719	$1,183,934	$1,207,612	$1,231,765	$1,256,400
$44,989	$45,889	$46,807	$47,743	$48,698	$49,672	$50,665	$51,679
$2,532,038	$2,582,679	$2,634,333	$2,687,019	$2,740,760	$2,795,575	$2,851,486	$2,908,516
$205,057	$209,158	$213,341	$217,608	$221,960	$226,399	$230,927	$235,546

-	-	-	-	-	-	-	-
$22,146	$22,589	$23,041	$23,502	$23,972	$24,451	$24,940	$25,439
$41,011	$41,832	$42,668	$43,522	$44,392	$45,280	$46,185	$47,109
$33,800	$34,476	$35,166	$35,869	$36,587	$37,318	$38,065	$38,826
$54,689	$55,782	$56,898	$58,036	$59,197	$60,381	$61,588	$62,820
$23,660	$24,133	$24,616	$25,108	$25,611	$26,123	$26,645	$27,178
$1,637,026	$1,669,767	$1,703,162	$1,737,226	$1,771,970	$1,807,409	$1,843,558	$1,880,429
$403,854	$411,931	$420,170	$428,573	$437,145	$445,888	$454,805	$463,901
$16,611	$16,944	$17,283	$17,628	$17,981	$18,340	$18,707	$19,081
$934,906	$953,605	$972,677	$992,130	$1,011,973	$1,032,212	$1,052,857	$1,073,914
$75,713	$77,227	$78,772	$80,347	$81,954	$83,593	$85,265	$86,971
-	-	-	-	-	-	-	-
$8,177	$8,341	$8,507	$8,678	$8,851	$9,028	$9,209	$9,393
$15,143	$15,445	$15,754	$16,069	$16,391	$16,719	$17,053	$17,394
$67,476	$68,825	$70,202	$71,606	$73,038	$74,499	$75,989	$77,508
$20,193	$20,597	$21,008	$21,429	$21,857	$22,294	$22,740	$23,195
$94,953	$96,852	$98,789	$100,765	$102,780	$104,836	$106,933	$109,071
$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500	$36,757,500
$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800	$12,214,800
$1,317,858	$1,344,216	$1,371,100	$1,398,522	$1,426,492	$1,455,022	$1,484,123	$1,513,805
$437,935	$446,693	$455,627	$464,740	$474,034	$483,515	$493,185	$503,049
$279,652	$285,245	$290,950	$296,769	$302,704	$308,758	$314,933	$321,232
$84,670	$86,363	$88,091	$89,852	$91,649	$93,482	$95,352	$97,259

1	*1*	*1*	*1*
2043	2044	2045	2046
65,000	65,000	65,000	65,000
24,000	24,000	24,000	24,000
-	-	-	-
2,400	2,400	2,400	2,400
3,250	3,250	3,250	3,250
1,080	1,080	1,080	1,080
1,950	1,950	1,950	1,950
86	86	86	86
-	-	-	-
-	-	-	-
-	-	-	-
$1,989,999	$1,989,999	$1,989,999	$1,989,999
$3,972,628	$3,972,628	$3,972,628	$3,972,628
-	-	-	-
$4,550,785	$4,641,800	$4,734,636	$4,829,329
-	-	-	-
$164,058	$167,340	$170,686	$174,100
$193,818	$197,694	$201,648	$205,681
$64,407	$65,695	$67,009	$68,349
$4,746,583	$4,841,514	$4,938,345	$5,037,112
$1,281,528	$1,307,158	$1,333,302	$1,359,968
$52,712	$53,767	$54,842	$55,939
$2,966,686	$3,026,020	$3,086,541	$3,148,271
$240,256	$245,062	$249,963	$254,962

-	-	-	-
$25,948	$26,467	$26,996	$27,536
$48,051	$49,012	$49,993	$50,992
$39,603	$40,395	$41,203	$42,027
$64,076	$65,358	$66,665	$67,998
$27,722	$28,276	$28,842	$29,419
$1,918,037	$1,956,398	$1,995,526	$2,035,437
$473,180	$482,643	$492,296	$502,142
$19,463	$19,852	$20,249	$20,654
$1,095,392	$1,117,300	$1,139,646	$1,162,439
$88,710	$90,484	$92,294	$94,140
-	-	-	-
$9,581	$9,772	$9,968	$10,167
$17,742	$18,097	$18,459	$18,828
$79,058	$80,640	$82,252	$83,897
$23,659	$24,132	$24,615	$25,107
$111,253	$113,478	$115,747	$118,062
$36,757,500	$36,757,500	$36,757,500	$36,757,500
$12,214,800	$12,214,800	$12,214,800	$12,214,800
$1,544,081	$1,574,963	$1,606,462	$1,638,591
$513,110	$523,372	$533,840	$544,517
$327,656	$334,210	$340,894	$347,712
$99,204	$101,188	$103,212	$105,276

Tonnage	tons	20	
One-Way Mileage to LF	mi	20	
Avg. Speed	mph	45	
Time per Trip	hrs	0.888889	
Driver Cost	$/hr	27.46154	Average wages in Montana, scaled up to accou
Miles per Gallon	mpg	2.5	
Fuel Cost	$/gallon	5.36	Average AAA Montana diesel price as of 05/29
Maintenance & Consuma	$/mi	0.36	
Profit Margin	%	0%	No profit assumed

Hauling Cost	$/trip	$/ton
Labor	24.41025641	1.220513
Fuel	85.76	4.288
O&M	14.4	0.72
Profit	0	0
Total Cost	124.5702564	6.228513

utn for 35% fringe benefits.

Table 1.1.9. Implicit Price Deflators for Gross Domestic Product

[Index numbers, 2017=100]

Bureau of Economic Analysis

Last Revised on: April 30, 2026 - Next Release Date May 28, 2026

Line		2012	2013	2014	2015	2016
Line						
1	**Gross domestic product**	**93.185**	**94.771**	**96.421**	**97.316**	**98.241**
2	**Personal consumption expenditures**	**94.534**	**95.781**	**97.121**	**97.299**	**98.284**
3	Goods	105.62	105.05	104.54	101.35	99.71
4	Durable goods	111.6	109.55	106.77	104.62	102.34
5	Nondurable goods	102.83	102.9	103.41	99.735	98.405
6	Services	89.648	91.659	93.795	95.462	97.629
7	**Gross private domestic investment**	**95.85**	**96.586**	**98.242**	**98.95**	**98.737**
8	Fixed investment	95.241	96.16	97.923	98.582	98.55
9	Nonresidential	99.13	99.229	100.17	100.35	99.38
10	Structures	90.209	91.474	96.213	97.719	97.668
11	Equipment	103.09	102.86	102.12	101.5	100.21
12	Intellectual property products	100.29	99.948	100.33	100.63	99.453
13	Residential	81.006	85.095	89.986	92.454	95.699
14	Change in private inventories	---	---	---	---	---
15	**Net exports of goods and services**	**---**	**---**	**---**	**---**	**---**
16	Exports	104.3	104.46	104.52	99.455	97.457
17	Goods	111.09	110.34	109.21	101.42	97.467
18	Services	91.79	93.61	95.88	95.849	97.44
19	Imports	112.36	110.89	110.07	101.28	97.825
20	Goods	116.44	114.18	112.66	102.05	97.81
21	Services	95.134	96.886	98.954	97.966	97.888
22	**Government consumption expenditures and gross investmen**	**93.46**	**95.634**	**97.578**	**97.581**	**97.766**
23	Federal	94.783	95.597	97.215	97.609	98.205
24	National defense	95.99	96.459	97.85	98.053	98.419
25	Nondefense	92.927	94.307	96.287	96.968	97.897
26	State and local	92.579	95.654	97.804	97.567	97.505
	Addendum:					
27	Gross national product	93.217	94.801	96.452	97.339	98.262

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
									Q1
100	**102.29**	**103.98**	**105.38**	**110.19**	**118.02**	**122.39**	**125.43**	**128.98**	**131.78**
100	**102.05**	**103.51**	**104.67**	**108.97**	**116.1**	**120.51**	**123.67**	**126.92**	**129.6**
100	100.81	100.43	99.666	104.6	113.64	115.04	114.54	115.33	117.53
100	98.633	97.686	96.814	102.18	108.79	107.98	105.75	106.18	108.35
100	101.94	101.85	101.15	105.83	116.27	118.96	119.49	120.51	122.72
100	102.63	104.97	107.09	111.04	117.13	123.09	128.12	132.64	135.57
100	**101.55**	**102.9**	**104**	**107.66**	**115.76**	**119.06**	**121**	**123.2**	**125.45**
100	101.57	102.96	104.25	108.04	116.51	120.04	122.09	124.36	126.68
100	100.43	101.41	101.97	103.15	109.32	112.79	114.32	116.05	118.2
100	101.17	105.26	106.85	110.43	128.37	135.03	134.7	135.89	138.79
100	99.921	99.982	99.461	99.908	106.07	110.87	113.17	115.72	119.14
100	100.58	100.74	101.9	102.61	103.55	104.42	106.14	107.35	108.09
100	105.64	108.6	112.51	125.16	141.78	145.42	149.66	154.26	157.18
---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---
100	103.33	102.83	100.28	111.82	122.83	120.95	122.09	124.07	127.26
100	103.55	101.85	97.869	111.7	124.72	119.36	118.92	119.88	122.72
100	102.91	104.69	104.99	111.69	118.47	123.62	127.85	131.78	135.59
100	102.66	101	98.891	106.03	113.67	111.36	112.21	112.74	115.11
100	102.71	100.47	97.766	105.21	113.07	109.46	109.97	110.02	112.44
100	102.46	103.31	104.03	109.57	116.1	119.68	121.99	124.71	126.88
100	**103.62**	**105.16**	**107.43**	**113.18**	**121.39**	**124.75**	**127.78**	**132.22**	**135.47**
100	102.78	104.35	105.42	108.92	115.19	120	123.9	130.28	133.24
100	102.64	104.07	105.37	109.23	116.08	120.89	125.39	130.88	135.15
100	102.97	104.77	105.5	108.52	114.05	118.86	121.95	129.54	130.67
100	104.13	105.64	108.65	115.86	125.31	127.74	130.23	133.45	136.87
100	102.23	103.91	105.31	110.11	117.94	122.3	125.34	128.89	---

Appendix H. National Renewable Energy Laboratory Opportunities for Wood Valorization

Lincoln County Montana
Opportunities for Wood Valorization

Robert M. Baldwin
National Renewable Energy Laboratory (NREL)
January, 2023

Summary

Lincoln County Montana has engaged with NREL through the Waste-to-Energy Technical Assistance program to provide advice and guidance concerning options for wood waste utilization and energy production from the County's supply of small-diameter roundwood that currently does not have an existing market. Background for this study includes information from a conference call held on August 30; primary take-aways from this conversation include:

- Feedstock supply: 250,000-275,000 green tons/year of small-diameter roundwood
- Applications to provide heat and power and/or residential and commercial natural gas are very important
- More information on technologies that are feasible is desired
    - marketability to the extent possible; how fast is the market side coming along to make it economically viable; who are the players and investors
- Case studies to see how others have dealt with it
- Interested in financing and funding opportunities – especially DOE

This very brief study will provide a very high-level overview of the options that are available with the objective of helping to identify potential technology solution pathways. This paper presents our thinking on technology with only minimal efforts to address questions of economics; case studies for similar situations are identified for reference but not analyzed in detail.

Background and Approach

Several resource utilization options have been evaluated including:

- Combustion for power generation and heat (combined heat and power or CHP)
- Pyrolysis
- Gasification
- Pelletization

Each of these options is explored in the following narrative.

Combustion for power generation combined with heat (CHP): In principle, simple combustion provides a feasible and low-cost solution that could be applied to the feedstock. Combustion of biomass to raise heat and power is commercial technology. Recovery and/or utilization of CO2 from the combustor flue gas (carbon capture and sequestration or CCS) is an option that could be considered for this application, however evaluation of the systems required to carry out CCS is beyond the scope of this project[1]. Use of wood for CHP technology at small scale has been demonstrated and deployed broadly, including the National Renewable Energy Laboratory in Golden Colorado where approximately 45% of NREL's South Table Mountain campus district heating needs are provided by a centralized wood-fired system (the Renewable Fuel Heating Plant). Information on this facility is shown in the Appendix. Other examples of CHP deployment are presented below with links to relevant information.

[1] Generally speaking, only certain locations with appropriate sub-surface geology are well suited for application of CCS

Fuel For Schools – 2001-2009: Montana Schools: Darby Public Schools, Victor Public Schools, Troy Public Schools, Glacier High School, University of Montana – western campus, Townsend Elementary and High Schools, Eureka Public Schools
https://www.pelletheat.org/assets/docs/Breakfast_luncheon_archives/2011/2011_fuels_for_schools_atkins.pdf
https://www.thewflc.org/sites/default/files/295_pdf.pdf

Darby, MT: The wood-fired heating system installed in Darby Schools replaced three separate oil-fired systems and saved the school district $24,500 of total fuel costs for the 2003-2004 year. The boilers were installed as part of the Fuels for Schools program in which mechanical thinning forest waste products are used as fuel for community energy applications.
https://www.fpl.fs.usda.gov/documnts/fplgtr/fpl_gtr173.pdf

Troy Public Schools, MT: Troy elementary school was converted to a pellet-fired heating system in 2007 and saves the school about $12,000 each year. In 2014, the school district received a $50,000 grant from the Department of Natural Resources and Conservation to install a similar system in the high school.
https://www.thewflc.org/sites/default/files/295_pdf.pdf
https://thewesternnews.com/news/2014/oct/07/troy-moves-from-fuel-oil-to-wood-12/

Chadron State College, NE: Operating for nearly 30 years, two Hurst wood fuel boilers replaced natural gas boilers at Chadron State College in Nebraska to heat and cool approximately 1.1 million ft^2 on campus. The boiler operates from approximately 9,000 tons of ponderosa pine woodchip generated from forest management activities.
https://ianrnews.unl.edu/nebraska-forest-service-receives-grant-evaluate-expansion-chadron-wood-energy-system
https://www.hurstboiler.com/news/chadron_state_college
https://www.hurstboiler.com/news/hurst_boiler_sponsors_fuels_for_schools

University of Idaho: University of Idaho uses a district energy system to heat and cool the campus. In 1986 the university secured and built a wood chip fueled boiler using wood waste/residues from lumber mills.
https://www.uidaho.edu/dfa/division-operations/utilities/energy

Northern Nevada Correctional Center, Carson City, NV: In June 2009, the Northern Nevada Correctional Center (NNCC) completed installation of a $6.4 million biomass system. The CH&P system produces 1 MW of electricity and requires 16,000 tons of wood annually. The system is estimated to save the NNCC $1 million per year. The wood is sources from slash piles created from forest management activities as well as landfills where it would otherwise be buried.
https://www.hurstboiler.com/news/hurst_boiler_sponsors_fuels_for_schools

Warm Springs Forest Products Industry, Confederated Tribes - Warm Springs Reservation, OR: The Warm Springs Forest Product Industries (WSFPI) operated by the Confederated Tribes of the Warms Springs operation currently runs and operates a large and small log mill and a wood fired power plant. The initial plant contained an 80,000 lb/h per hour boiler that produced 3 MW per hour.
https://www.energy.gov/sites/prod/files/2016/01/f28/0610review_10mukumoto.pdf
https://www.fpl.fs.usda.gov/research/units/fpmu/small_diameter_roundwood.shtml

Pyrolysis: The process of pyrolysis consists of heating a material to temperatures in the range between (generally) 500 – 600 °C in the absence of air such that combustion does not take

place. Products from thermal pyrolysis consist of a char (referred to as biochar), non-condensable gases (largely CO and CO2 with some light hydrocarbons), and a condensable organic liquid known as bio-oil. This bio-oil retains much of the heating value of the feed biomass and could - in principle - be used for generating electricity in either a steam or gas turbine or used for home or district heating. Pyrolysis can be classified as fast and slow process depending on the heating rate, temperature, residence time and pressure. Slow heating rates on the order of just a few degrees per minute produce mostly char with some bio-oil; fast heating rates (flash or fast pyrolysis) of hundreds of degrees per second produce more bio-oil; 60 to 70% of the feedstock can be liquefied to make bio-oil using fast pyrolysis. In North America, Ensyn[2] has commercialized fast pyrolysis of woody biomass to produce a heating oil that is a direct substitute for its fossil counterpart. BTG[3] is another pyrolysis technology provider in Europe operating commercial plants. Their target product is bio-oil which is used in part to replace natural gas in steam boilers. One of their most recent plants upgrades bio-oil to renewable transportation fuels. Alder Fuels recently announced that it will be using BTG's technology in the US to make bio-oil from woody biomass that they will process further into sustainable aviation fuel.[4] Also, Clean Energy Technologies, Inc. has entered into an agreement with Synergy Bioproducts Corporation to design, build and operate a processing plant in Vermont that will produce bio-oil from woody biomass and use it to supply renewable electricity locally.

We understand that the County's priority is in wood processing technologies generating energy, however, we would like to note that some companies are optimizing their pyrolysis process to produce biochar, a valuable soil amendment. One such project is a biochar demonstration project near Gold Creek, Montana. The project is utilizing small trees cut from forest thinning and restoration work that would have otherwise been burned in slash piles. The project is under observation by The Nature Conservancy, Bureau of Land Management, U.S. Forest Service, and private landowners.[5] The project is using a first-of-its-kind carbonator made by Tigercat called the Tigercat 6050.[6] The company states that their carbonization process reduces wood debris down to 5% - 7% of its original volume.[6]

Gasification: This technology is based on conversion of carbonaceous materials into a mixture of carbon monoxide and hydrogen known as synthesis gas (or syngas). Gasification is a very old technology, having been first practiced commercially in the USA to produce 'town gas' for use as a fuel for gas streetlamps as early as 1816. Gasifier types include batch and continuous, updraft, downdraft, indirectly heated, directly heated, and plasma; an excellent review of gasifier types and applications has been published by NREL.[7] Large-scale coal gasification coupled with catalytic syngas conversion – known as the Fischer-Tropsch process – has been used in several commercial large-scale applications most notably in Germany during World War II and more recently in South Africa.

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[2] http://www.ensyn.com/
[3] www.btg-bioliquids.com
[4] https://biomassmagazine.com/articles/19475/alder-fuels-to-utilize-btg-bioliquids-fast-pyrolysis-technology
[5] https://www.seeleylake.com/story/2022/11/10/news/biochar-benefits-studied-in-the-blackfoot-valley/9012.html
[6] https://can-bv.ca/wp-content/uploads/2020/04/2020-03-23-Carbonator-1.pdf
[7] "Biomass Gasification Technology Assessment Consolidated Report," M. Worley and J. Yale, Harris Group Inc., Atlanta, Georgia, prepared for the National Renewable Energy Laboratory, November 2012.

Feedstock availability is quoted to be approximately 250,000 tons per year, which translates to about 685 tons per day or ~30 tons/hour assuming 24 hour-per-day operation and a 90% stream factor[8]. This is a relatively modest feedstock supply rate but is well suited for biomass gasification technology providers who can downscale their technology for small-scale unit operations. Gasifiers are typically described in terms of the potential for generating electrical energy. Accordingly, a conversion was made to characterize potential electrical output from a gasifier processing 1 metric tonne per hour[9]; these calculations with assumptions are shown in Table 1; results and conversion factors can be scaled linearly to 30 tons/h.

Biomass HV								
7500	Btu/lb							
17.445	MJ/kg							
17445	MJ/MT							
Basis 1 MT/h								
1	MT/h			**1 ton/h is roughly 1 MW electricty equivalent**				
17445	MJ/h							
4.845833333	MJ/s							
4.845833333	MW							
4845.833333	kW							
22.70%	efficient to electricity per https://ucanr.edu/sites/WoodyBiomass/files/79012.pdf)							
1100.004167	kW efficient							
1.1	MW efficient							

Table 1. Gasifier thermal to electrical conversion

As can be seen, 1 ton per hour MSW with an assumed heating value of 7,500 BTU/lb is equivalent to approximately 1 MW electrical energy generation hence 30 tons/h biomass will produce approximately 30 MW of electrical energy.

Biomass Gasification Technology Providers: The International Energy Agency Bioenergy Task 33 (biomass gasification) published a comprehensive status report[10] in 2019 on biomass gasifiers in the member countries. This report indicates that there are many implementations at or around this range of operation. Technology providers in the USA include the following companies:

- SunGas Renewables
- Enerkem
- Thermochem Recovery International
- Frontline
- TCG Global
- MDGS

Of these 6, both SunGas and Enerkem use pressurized oxygen-blown gasification as the downstream applications require a very clean syngas – capital cost (CAPEX) is correspondingly high. The other 4 use low-pressure steam-reforming (or similar) gasification technology and costs are lower. Biomass gasification generally suffers from mechanical complexity and high CAPEX, both of which are serious drawbacks for this application. Recently a rotary gasifier has

[8] 250,000/(365*.9)/24 = 30.02
[9] A metric tonne is 1,000 kg which is approximately equivalent to an English ton (2,000 lb)
[10] http://task33.ieabioenergy.com/content/Task%2033%20Projects

been developed and commercialized by MDGS[11] that seems to offer mechanical simplicity and lower CAPEX at significant throughput (440 tons/d). While developed for use with MSW, application to woody biomass should be straightforward.

Impact of feedstock heterogeneity: Gasifiers are somewhat complex devices that require a reasonably constant feedstock in terms of flowrate and composition. Gasifiers are not an on-demand unit operation that can be turned on and off to meet changing requirements. Once up and running it is important (even essential) that steady-state operation be maintained. Dramatic changes in the composition or flowrate of the feed will cause upsets in operations, which will have extremely deleterious impacts on downstream applications such as power generation.

Feedstock Pre-sorting Requirements: An advantage to gasification is that it can handle highly heterogeneous feedstocks including mixtures of wet waste (food waste and bio- solids), cellulosics (paper, cardboard), lignocellulosics (wood), and plastics. Feedstock used for gasification will need to be sorted to remove inorganics such as glass and metal and other contaminants in the unlikely event that these materials are present.

Feedstock Preparation Requirements: Feedstock to the gasifier will require significant size reduction and may require additional pre-processing in order to satisfy feeder systems and the need for homogeneity. This is especially true if the gasifier operates above atmospheric pressure. Generally, gasifier feed requires a certain level of dryness to operate at maximum efficiency; <10% moisture is a good rule of thumb. Examples of elaborate feed pre-processing systems can be found in the literature[12]

Downstream Applications: The primary application for syngas made by gasification of wood would be combustion to generate heat and power (AKA combined heat and power or CHP). It is likely that the syngas would have sufficient heating value for this application, however some syngas cleaning may be needed to remove tars. Syngas would be burned in a gas-fired turbine to produce electricity; waste heat from the turbine could be used for purposes of feedstock drying and/or to satisfy local heating needs. As shown above, approximately 30 MW electrical is anticipated to be produced. In addition to syngas, a highly carbonaceous residue - bio-char - will be produced. Bio-char production is highly dependent on the feed composition but it can be assumed that the bio-char production rate will be between 1 and 10% of the input feedrate – amounting to as much as 3 tons/hr (maximum) of this material. The ultimate disposition of this material is one problem that is not addressed in this analysis, but possible uses include as a material for soil amendment thus achieving carbon sequestration and improving the carbon footprint of the operation. The economic value of and sales potential for the biochar is not able to be estimated at this time.

Pelletization: We understand that the County is not prioritizing wood pellets manufacturing at this time. However, for completeness and awareness, we provide a brief overview of this technology for consideration among other thermochemical conversion pathways. Increasingly, harvesting forest residues and low-quality logs are used as raw material for wood pellets.[13] By making wood pellets from waste material that was once burned or left behind, wood pellets manufacturing is reducing waste and turning that debris into valuable, low carbon biofuel. Wood

[11] (https://www.mdgsus.com/recycling-solutions-technology-inc)
[12] The Effects of Non-recycled Plastic on Gasification, Demetra A. Tsiamis and Marco J. Castaldi, Earth Engineering Center | City College City University of New York, April 30, 2018
[13] https://www.naturallywood.com/products/wood-pellets/#:~:text=To%20create%20wood%20pellets%2C%20producers,of%20up%20to%2040%20mm

pellet manufacturing is a well-established process, and the general steps include drying, crushing, compressing, and cooling of the final product. In addition to being a high energy-value product, wood pellets can be easily handled and transported efficiently over long distances.[13] Pelletizing machines are relatively inexpensive (approximately $50,000 in $2009) and can produce 5-10 tons of pellets per hour.[14] However, complete manufacturing facilities can cost between $3-4 million and require considerable operating expenses and labor inputs. It takes 1.1 MBTUs of electrical energy to produce a ton of delivered pellets which could be supplied with renewable energy such as solar panels. While most wood pellets manufacturing in the US occurs in eastern states, there are some facilities in the mountain and northwest regions including Montana, e.g., Superior Pellet Mills and RBM Lumber.

Conclusions and Recommendations

A summary of risk factors for the five technologies evaluated is shown in Table 2.

Process	Environmental	Complexity	Waste Reduction Potential	CAPEX	OPEX	Overall Feasibility
Combustion						
Pyrolysis						
Gasification						
Pelletization						

Table 2. Summary of risk factors

Our recommendation is that the County considers examining the listed thermochemical conversion options in more detail by engaging with technology providers and looking at economic factors including CAPEX and OPEX to help inform a final decision.

Acknowledgements

The author (RMB) wishes to acknowledge Dr. Anelia Milbrandt and Daniel Carpenter from The National Renewable Energy Laboratory for their contributions to this document.

[14] https://extension.tennessee.edu/publications/Documents/W214.pdf

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Appendix

Renewable Fuel Heating Plant

National Renewable Energy Laboratory

SYSTEM SPECIFICATIONS

Manufacturer:
Advanced Recycling Equipment (Pennsylvania)

Owner: Ameresco

Fuel: Wood waste and forest thinnings from Colorado's Front Range

Total output:
29 billion Btu annual estimated output
(41 billion Btu total natural gas savings due to conversion efficiency of natural gas combustion)
The facility is designed to meet additional future heating loads, so annual output will increase when the Research Support Facility comes online

What it will heat:
The research buildings on NREL's South Table Mountain Campus

Displaced fuel: Natural gas
Ultimately, plant could displace up to 75% of NREL's South Table Mountain natural gas use

Project completion date:
Construction will be completed by May 2008

Location: NREL South Table Mountain Campus

Financial Terms

ESCO owned and maintained: Ameresco finances the construction of the plant and buys the wood waste; the company will be repaid with the proceeds from NREL's natural gas utility cost savings
There will be no upfront or additional future costs to the taxpayer

Fully-loaded cost: $3.3 million (borne by Ameresco)

First-year plant savings (in natural gas costs): $400,000

Contract term (to purchase heat): Capital will be paid off in ~25 years

Wood waste contract:
Ameresco has the responsibility for obtaining the wood waste
- Ameresco has a long-term contract with A-1 Organics, which includes ash hauling
- Initial price: $29/ton or $2.42/MMBtu (NREL historical two-year average natural gas cost is $9.97 MMBtu)

DOE/NREL Energy Impact

Total NREL heating consumption: 56 billion Btu
The South Table Mountain portion of this is 47 billion Btu

% plant will be of total NREL heating load: 52%

% plant will be of Table Mountain Campus heating load: 62%
(this number will increase as the system is designed to serve heating loads associated with the new Research Support Facility)

Environmental Impact

Carbon offsets: The plant initially will offset 4.8 million pounds of CO_2 (or 2,200 metric tonnes of carbon) each year

TEAM Initiative & Executive Order 13423: Facility will help work to goal of 30% reduction in energy intensity and GHG reduction by 2015 across all DOE sites

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EERE Information Center
1-877-EERE-INF (1-877-337-3463)
www.eere.energy.gov

DOE/GO-102008-2545
January 2008

Appendix I. Stolz Project Profile

UPPER-WEST

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

F. H. Stoltze Land & Lumber Lumber Mill

3.75 MW CHP Facility

IMAGE COURTESY OF F.H. Stoltze Land and Lumber

Quick Facts

LOCATION: Columbia Falls, Montana
MARKET SECTOR: Lumber Mill
FACILITY PEAK LOAD: 3.75 MW
EQUIPMENT: Wellons Steam Boiler; Dresser Rand Extraction Turbine
FUEL: 60,000-65,000 Green Tons wood residue (30-35k Bone dry tons)/year
USE OF THERMAL ENERGY: Drying of lumber, space heating
ENVIRONMENTAL BENEFITS: Drastically reduced CO2 emissions and maximized water use efficiency.
TOTAL PROJECT COST: $22 million
PAYBACK: 20 years
CHP IN OPERATION SINCE: 2013

Site Description

F.H. Stoltze Land & Lumber began operations in 1912, located between Whitefish and Columbia Falls, Montana. The multi-product sawmill is one of the few family-owned lumber companies remaining in the Northwest, employing approximately 120 people and managing about 38,000 acres of timberland. The 145 acre site includes a sawmill, dry kilns, planning mill and various administrative offices. In 2012, Stoltze upgraded their boilers to a brand new cogeneration facility. A Power Purchase Agreement between Stoltze and Flathead Electric Co-Op began in October of 2013. This PPA extends over a 20 year period.

The Stoltze Co-Generation Power Plant burns residual fiber (wood waste) that comes from the mill and from outside sources (Post and Pole plants or in-woods grinding) to produce high pressure steam. This super-heated steam spins a turbine which creates around 2.5 MW/HR of electricity all of which is sold to the grid. As the steam loses pressure and energy, 50 PSI steam is extracted out to dry lumber and use on-site for heating buildings. The mill produces approximately 70 MM board feet of lumber annually that has been dried in these kilns.

Reasons for CHP

Several reasons led to the decision to incorporate CHP into Stoltze's operations. One of the primary goals was to increase efficiency in drying lumber through the replacement of five existing boilers that had been running between 50-60% efficiency or less. Other key drivers include:

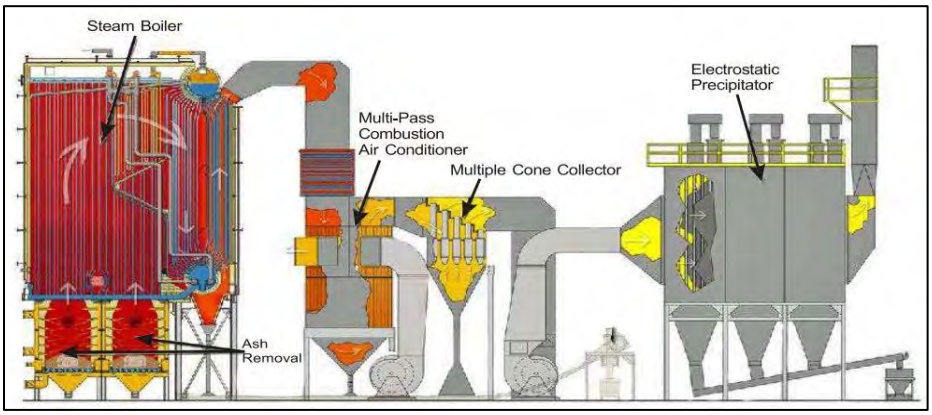
- Diversification of the company's business beyond solid-wood products by including electricity generation
- Increase lumber drying efficiency in dry kilns by replacing the aging boilers
- Improve air quality through the reduction of boiler emissions and decreasing slash pile burning in the forests

- Create an outlet for biomass residues from forest management activities – also adding market security to manufacturing activities for by-product values

Cogeneration System and Operation

The equipment in this system includes:

- Wellons, single cell, watertube modular constructed boiler system
- Dresser Rand extraction turbine
- Toyo Denki Power Systems Generator with a max capability rating of 3750 KW.



Boiler and emissions equipment diagram
IMAGE COURTESY OF MONTANA DEQ

The CHP system at Stoltze includes the high-pressure steam boiler, a turbine, a generator, an electrostatic precipitator, cooling tower, fuel storage, fuel delivery conveyers and piping for the steam delivery system for the dry kilns. The biomass (fuel), consisting of bark, sawdust, planer shavings and forest/log yard hog fuel, feeds into the boiler, which can produce around 40,000 pounds per hour of superheated steam (725°F) at 650 pounds per square inch gauge. This is used in the kilns to dry lumber, provide heat for the sawmill and spin the turbine generator.

The installation of the high-pressure boiler required licensed boiler engineers with certification to operate such systems. A partnership with a local community college enabled training curricula in order to fulfill these jobs.

Lessons To Share

A key success factor to note is that the turbine has a 93% uptime for the past five years (since 2015). This includes planned and unplanned down time.

Several lessons were learned throughout this project such as:

- Just because it's a new plant doesn't mean there aren't ways to make improvements. In the past four years Stoltze has reduced their well water use by over 7 million gallons per year.
- There was an unexpected cost for infrastructure upgrades. This one-time cost was in addition to the interconnection agreement between Stoltze and Flathead Electric.
- Stoltze is working with the Montana Department of Environmental Quality (DEQ) to identify potential markets for the wood ash resulting from the new boilers, such as use on farms and ranches to neutralize manure in pastures and/or amendment for topsoil. Previously, ash from the old boilers was combined with other wastes and disposed in the county landfill.

> *"Make the highest quality steam at the **lowest possible cost."***
>
> *- Lee Starkel*
> *Steam and Power Plant Manager*
> *F. H. Stoltze Land & Lumber Company*

For More Information

U.S. DOE **UPPER-WEST** CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)

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