MID-CASCADE TO PACIFIC CORRIDOR

Volume III | CONCEPTUAL DESIGN

Northwest Advanced Renewables Alliance

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ACRONYMS

AFRI	Agriculture and Food Research Initiative
AHB	Advanced Hardwood Biofuels Northwest
BDT	Bone Dry Tons
Brownfield	Abandoned or underutilized site with real or perceived contamination
CAPS	Coordinated Agricultural Projects
CAAM	Community Asset Assessment Model
C&D	Construction and Demolition Debris
CIA	Community Impact Analysis
CY	Cubic Yard
Greyfield	Vacant or underutilized site with no contamination
IDX	Integrated Design Experience
IO	Input-Output Analysis
LCA	Life Cycle Assessment
MRF	Material Recycling Facility
MSW	Municipal Solid Waste
N&E	New and Emerging
NARA	Northwest Advanced Renewables Alliance
NIFA	National Institute of Food and Agriculture
OSU	Oregon State University
RFA	Resource Flow Analysis
RWW	Recycled Wood Waste
SLA	Site Location Analysis
TEA	Techno-Economic Analysis
UI	University of Idaho
USFS	United States Forest Service
MC2P	Mid-Cascades to Pacific
WSU	Washington State University

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Northwest Advanced Renewables Alliance

Mid-Cascade to Pacific Corridor

3.1.0 INTRODUCTION

NARA

Northwest Advanced Renewables Alliance

NARA (Northwest Advanced Renewables Alliance) was initiated in 2011. It is one of six regional bioenergy Coordinated Agricultural Projects (CAPs) within the Sustainable Bioenergy challenge area funded by the USDA National Institute of Food and Agriculture (NIFA) in its Agriculture and Food Research Initiative (AFRI) program. CAPs in Sustainable Bioenergy are charged to:

> facilitate the establishment of regional systems for the sustainable production of bioenergy and biobased products that: contribute significantly to reducing the National dependence on foreign oil; have net positive social, environmental, and rural economic impacts; and are integrated with existing agricultural systems (USDA NIFA 2010).

This charge is being addressed by NARA through collaborative research, education and workforce development, as well as technology transfer through outreach activities.

GOALS AND OBJECTIVES:

NARA's primary challenge is to envision and facilitate an environmentally, economically, and socially sustainable wood-based biofuels and co-products industry in the Pacific Northwest. Towards this end, NARA's five specific goals include:

1) SUSTAINABLE BIOJET: Develop a sustainable biojet fuel industry in the Pacific Northwest that uses residual woody biomass as feedstock.
2) VALUE-ADDED POLYMER AND CARBON PRODUCTS FROM LIGNIN: Create valuable co-products made from lignin, an industrial byproduct of the woody biomass-to-biojet process
3) RURAL ECONOMIC DEVELOPMENT: Sustain and enhance rural economic development
4) REGIONAL SUPPLY CHAIN COALITIONS: Facilitate and promote supply chain coalitions within the NARA region
5) BIOENERGY LITERACY: Improve bioenergy literacy to develop a future work force and enhance stakeholder understanding

In collaboration with stakeholders in Washington and Oregon, NARA identified the Mid-Cascade to Pacific (MC2P) region for its 2013/2014 pilot supply chain study. The MC2P Region is shown in Figure 3.1.1.

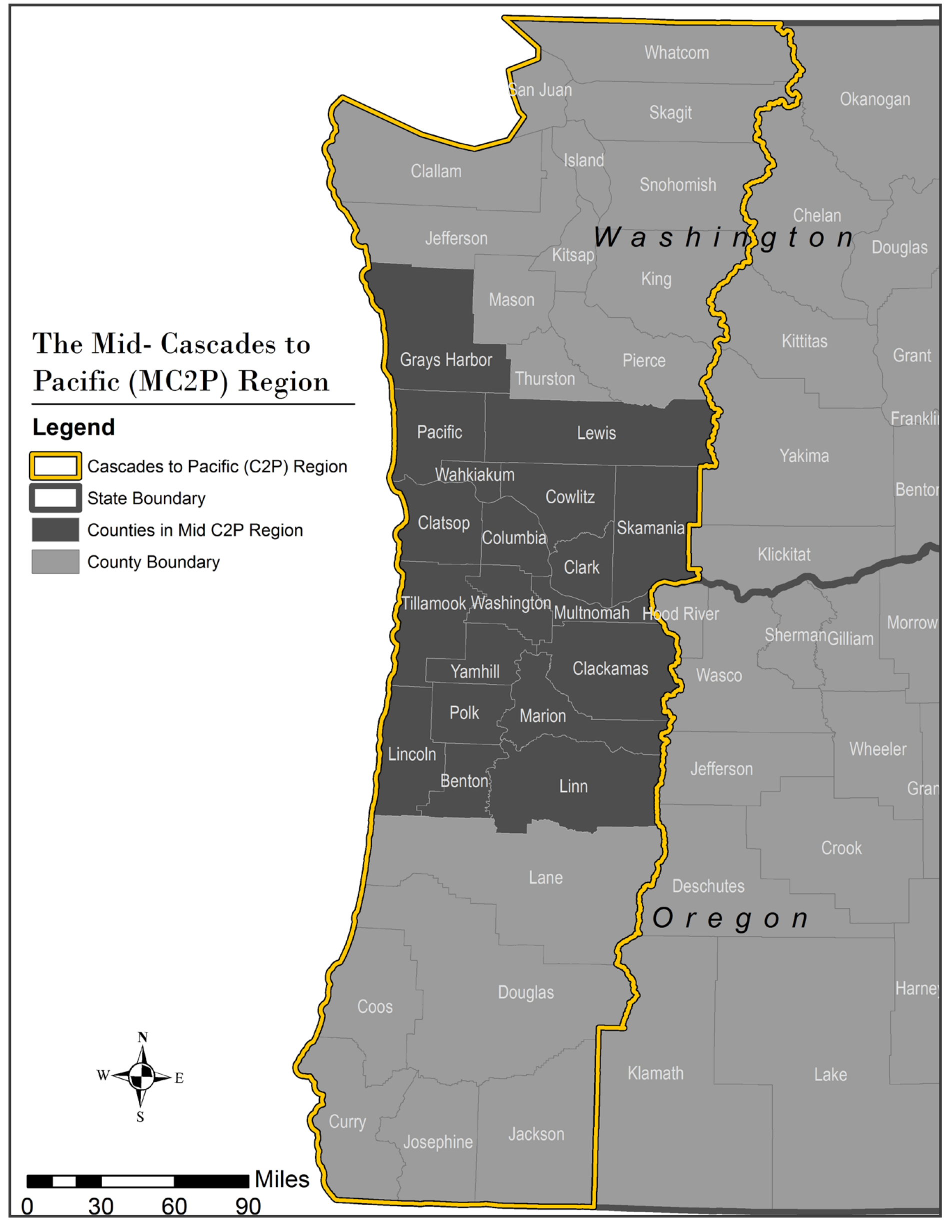

Figure 3.1.1. NARA MC2P study region

This document, MC2P Volume III, presents final student design concepts prepared by the Integrated Design Experience (IDX) studio: a collaborative course for undergraduate and graduate students offered by the University of Idaho and Washington State University and supported through NARA. Site analysis, opportunities and constraints, and conceptual designs are presented for solids and liquids depots and an integrated biorefinery. Figure 3.1.2 illustrates the different facility types examined.

A depot is a pretreatment facility that prepares the biomass for processing in a conversion facility.

Two depot options are being investigated:

- Solids Depot: a pre-conversion facility that receives and mechanically processes post-harvest forest residuals, forest thinnings, and/or construction and demolition (C&D) waste biomass so that it can be shipped by rail or highway truck to a receiving liquids depot, conversion plant, IBR or other potential end user (e.g., fuel pellet manufacturer).
- Liquids Depot: a pre-treatment facility that receives raw and mechanically processed woody biomass directly from nearby forests or from a solids depot. A liquids depot converts the woody biomass into a concentrated sugar-rich syrup. The syrup would then be transported to facilities for the conversion to isobutanol,bio-jet fuel, or other value-added products.

An integrated biorefinery (IBR), for this study, is a high-capacity facility that converts post harvest forest residuals , or other woody biomass, into biojet fuel and valuable co-products.

Design concepts provided in this document relate to the following sites:

Solids Depot Sites:

- the former Bradley Lumber Company site, Bradwood, OR (brownfield site)
- Sierra Pacific Industries, Aberdeen, WA

Liquids Depot Sites:

- the former Weyerhaeuser Bay City Log Yard, Aberdeen, WA (brownfield site)
- Kapstone Paper and Packaging, Longview, WA

Integrated Biorefinery Sites:

- Cosmo Specialty Fibers, Cosmopolis, WA (co-location with existing facility)

To read about MC2P regional assets and the NARA supply chain, please read Volume I - the MC2P Profile document. To learn more about the site selection process IDX undertook to identify the case study sites, please read Volume II - the MC2P Analysis document. Both documents are available at: https://research.libraries.wsu.edu/xmlui/handle/2376/5661.

NARA fully recognizes that the quality of these volumes depends on the quality of the input data. As the project evolves, NARA continues to welcome regional stakeholders feedback on these ‘living documents’.

To find out more about NARA and other supply chain regions, please visit www.nararenewables.org. To sign up for NARA updates and newsletters, please go to http://nararenewables.org/org.

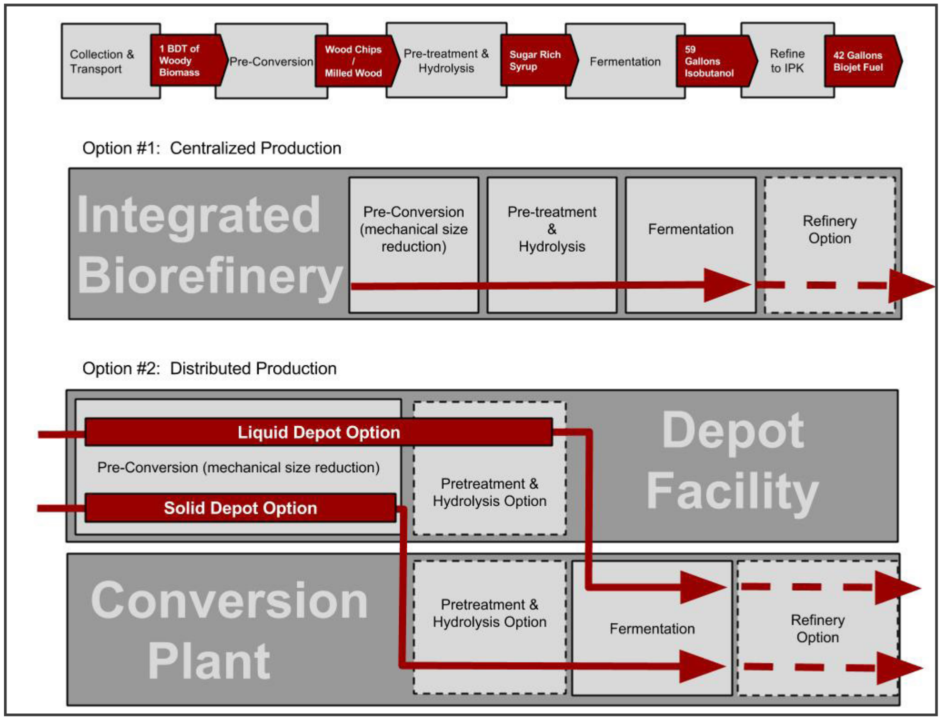

Figure 3.1.2. Diagram of NARA facility types

3.2.0 SOLIDS DEPOT

A solids depot is the smallest type of operation, in scale and in its range of onsite processes, in the wood-to-biofuel supply chain. A solids depot is estimated to process approximately 100,000 bone dry tons (BDT) of post-harvest forest residuals and construction and demolition (C&D) debris each year. At a solids depot, the biomass feedstock is mechanically reduced by grinding and chipping. Solids depots are typically located in close proximity to the feedstock source and to truck or rail lines.

A solids depot supplies chips to a liquids depot or to an integrated biorefinery (IBR). Key assets that impact the site selection for a solids depot are:

- Available feedstock
- Highway access
- Railway access
- Electricity rate

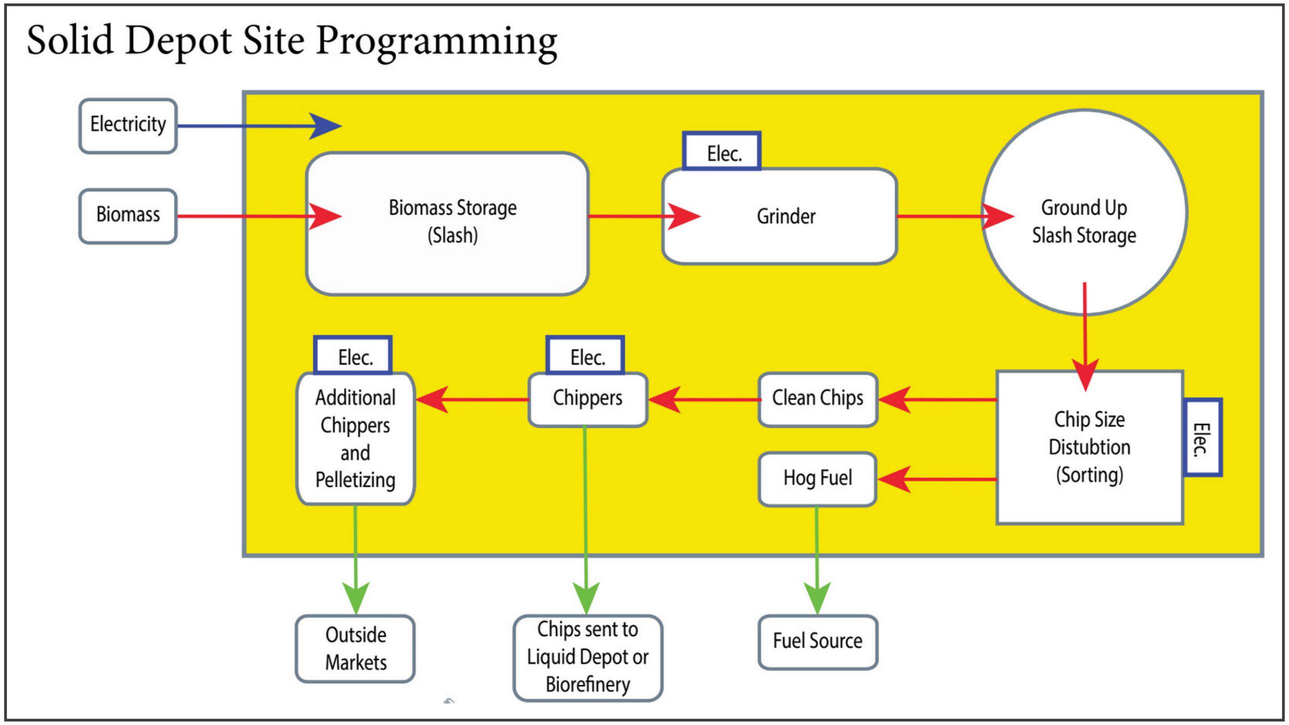

Figure 3.2.1. Solid depot site programming

3.3.0 FORMER BRADLEY - WOODWARD LUMBER COMPANY - BRADWOOD, OR

3.3.1 SITE DESCRIPTION

The former Bradley-Woodward Lumber Company site is located at the former Bradwood Landing in Clatsop County, Oregon, approximately 22 miles upriver from Astoria. Historically, the site operated as a saw mill from the early 1900s and is strategically adjacent to the Columbia River with 500 feet of water frontage that could accommodate shipping and receiving by barge. In addition, the site is next to a former rail spur (Bradley-Logging Railroad). The saw mill closed permanently in June 1962, and in 1965 the old buildings were destroyed in a fire.

The site is currently owned by Leahy Construction (Ken Leahy) in Cornelius, Oregon. The site has a few small outbuildings, but the majority of the land is undeveloped. Fifty acres, of the total 400 acre parcel, is zoned for marine industrial usage, 10 acres for a rock quarry, 75 acres as wetlands, and 265 acres as forest land. The property is accessed from Highway 30 and is located 77 miles west of Portland, Oregon and approximately nine miles from Interstate -5.

In addition to being evaluated by NARA for a biomass solids depot operation, other industrial siting ideas have been considered for this property. In the late 2000's, the site was considered for a liquified natural gas (LNG) export and import facility. The LNG business partners dredged the Columbia River to make the site ready for a deep-water port. The dredged material was placed on site creating a new foundation composed of dredged materials and sandy soils. However, after making these improvements, the LNG project leaders decided that the location of the port was insufficient for their purposes and sold the site.

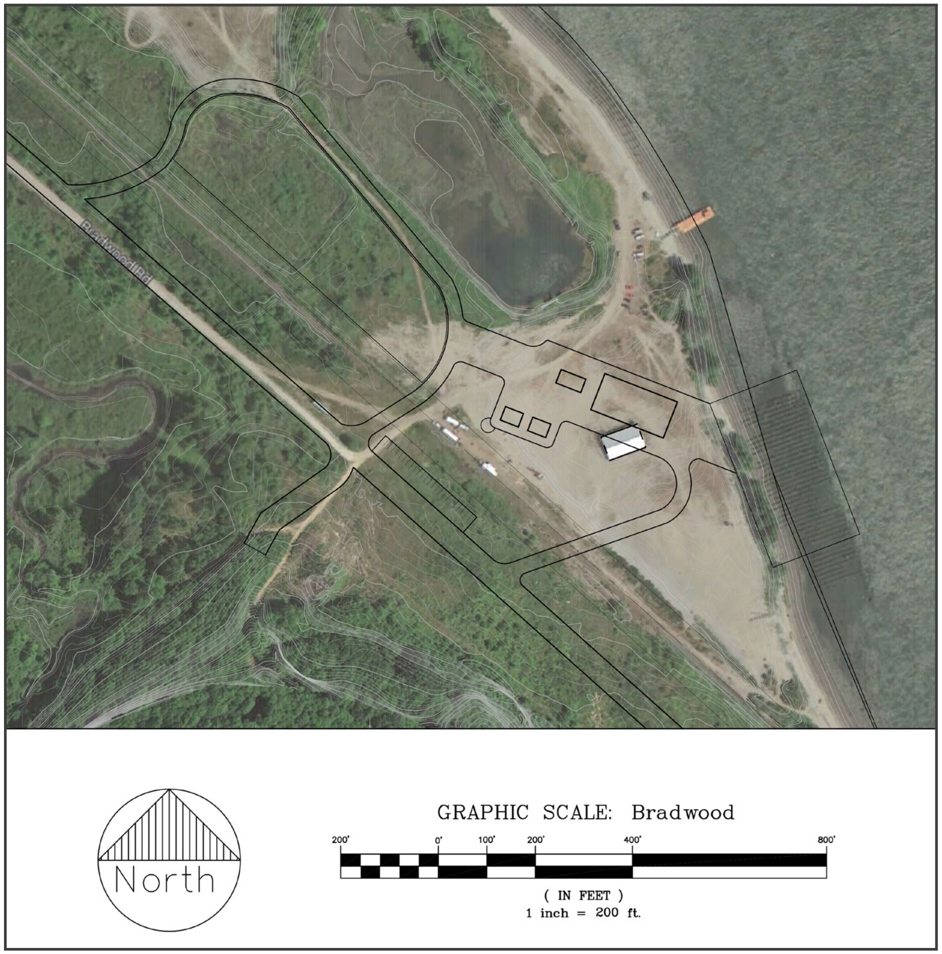

Figure 3.3.1. Site map of former Bradley-Woodward Lumber Company in Bradwood, OR

3.3.2 BRADLEY-WOODWARD LUMBER CO. OPPORTUNITIES AND CONSTRAINTS

Several opportunities and constraints were identified at the Bradley-Woodward Lumber Company site that should be taken into consideration for a potential solids depot. Natural, physical and civic attributes of the site were considered when evaluating opportunities and constraints.

The Bradley-Woodward Lumber Company site presents opportunities to reuse the property for activities similar to what it had been used for in the past. Direct access to nearby highways, as well as to an existing rail spur, makes for efficient transport of biomass materials to and from the site. The shallow slope of the site adds to the ease of solids depot operations, and an existing wetland area would provide a natural buffer between the site and neighboring properties (75 acres zoned wetland). The site has plenty of buildable land available for solids depot structures (50 acres zoned industrial marine) in addition to an existing rock quarry (10 acres) and 265 acres of forested lands onsite.

Because of the proximity to the river, full use of the shipping dock would involve permitting from the Army Corps of Engineers for dredging and dock restoration, and to ensure protection of salmon spawning in the nearby Hunt Creek during potential construction and operation activities. The existing railspur would need to be reconnected for shipping to both Portland and Astoria. Currently, the existing railroad only connects Portland to the Georgia Pacific Wauna Mill site, which is approximately 10 miles east of the Bradley-Woodward Lumber Company site. Rail transportation could be restored to the Bradley-Woodward Lumber Company site with minor improvements and modifications. This action could allow rail transport as the predominant mode of chip transport from the depot site to the Portland metropolitan area for further biofuel processing.

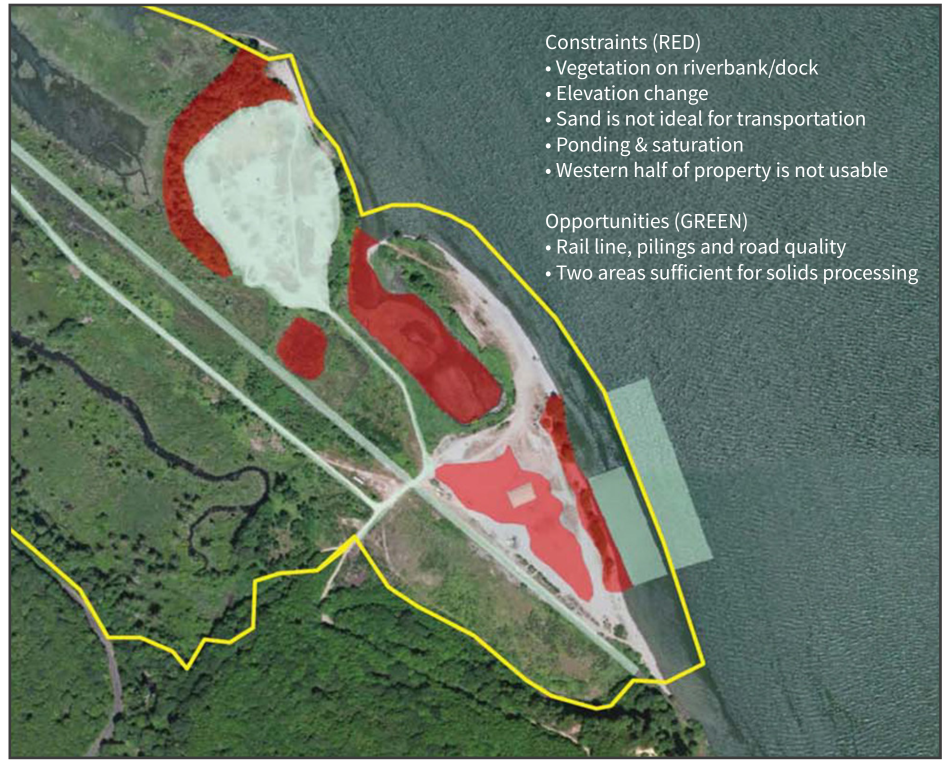

Figure 3.3.2. Bradley-Woodward Lumber Company opportunities and constraints

3.3.3 BRADLEY LUMBER COMPANY FINAL DESIGN CONCEPT

Each design case study provides a brief description of the site, site opportunities and constraints related to depot operations, and the final proposed site layout (e.g., master plan) for a proposed depot facility at this location. The final site design concept is intended to maximize the efficiency of the solids depot operations.

A one-way road network facilitates the smooth travel of the transport trucks from off-loading to reloading and back to the main site access road. The on-site roads are designed for one-way traffic to avoid congestion which allows for narrow roads. This consideration reduces the paved area of the site. The chip storage facility is placed close to the docks to provide easy access so that finished products can be loaded onto barges for shipment to market.

The site includes a paved storage facility for slash that is accessible by a ring road. The ring road provides site access from the northwest and flows around the slash storage area to exit at the southeast end. The large paved strip leading to the chipping and chip storage facilities serves a dual purpose to allow post -harvest forest residual (slash) transfer from storage to the chipping facility and to allow truck access to the chip storage facility for loading. Trucks can either exit immediately after unloading slash or proceed to the chip storage facility to load finished chips for transport and exit by the access road adjacent to the dock at the east end of the site. On the south side of this paved strip is an office structure for business operations and a large shop for equipment repairs and fabrication. Between the railroad and main site access road is an employee parking area, which will accommodate the vehicles of all employees plus a few extra spaces for visitors to the site. Finally, between the ring road and the Columbia River is the stormwater wetland.

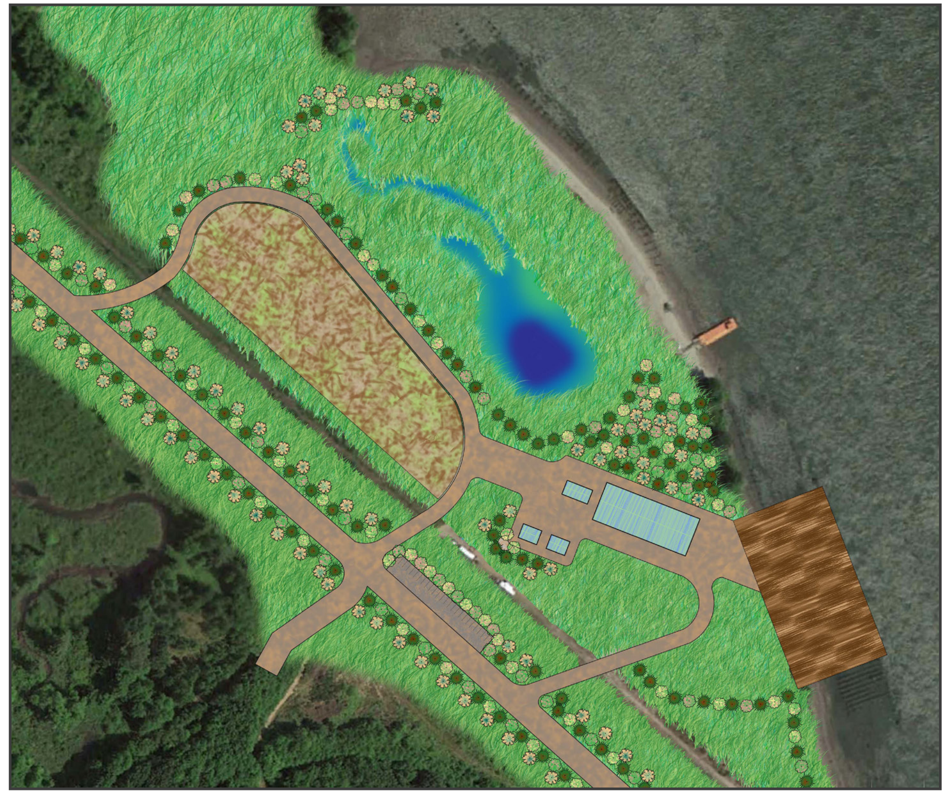

Figure 3.3.3. Bradley-Woodward Lumber Company final design concept

3.4.0 SIERRA PACIFIC INDUSTRIES - ABERDEEN, WA

3.4.1 SITE DESCRIPTION

The Sierra Pacific Industries (SPI) sawmill is located at 301 Hagara Street, in Aberdeen, Grays Harbor County, Washington. SPI owns a total of 76 acres which is divided into two parcels. One parcel contains the active log yard and sawmill buildings; it is approximately 30 acres and is adjacent to the Chehalis River. The second parcel of land is located just east of the sawmill operations across Junction City Road and is approximately 46 acres; this site is mostly unimproved except for a few miscellaneous storage and equipment sheds and an employee parking area. The Olympic Highway (Hwy 12) is within a half mile of the plant, and the I-5 corridor is approximately 60 miles away.

The SPI sawmill site was developed in 2001 and is privately-owned by the Emerson Family from California. The site was previously used for log storage. SPI produces all of its own electricity from its cogeneration facility. The cogeneration unit burns hog fuel, which is any excess wood material that is not used to produce lumber or pulp chips. The cogeneration unit can produce 18 megawatts of power per hour (which is approximately the equivalent of 25,000 horsepower). SPI operations generally require 5 to 6 megawatts. SPI sells their excess electrical power to the Puget Sound Energy and the City of Aberdeen.

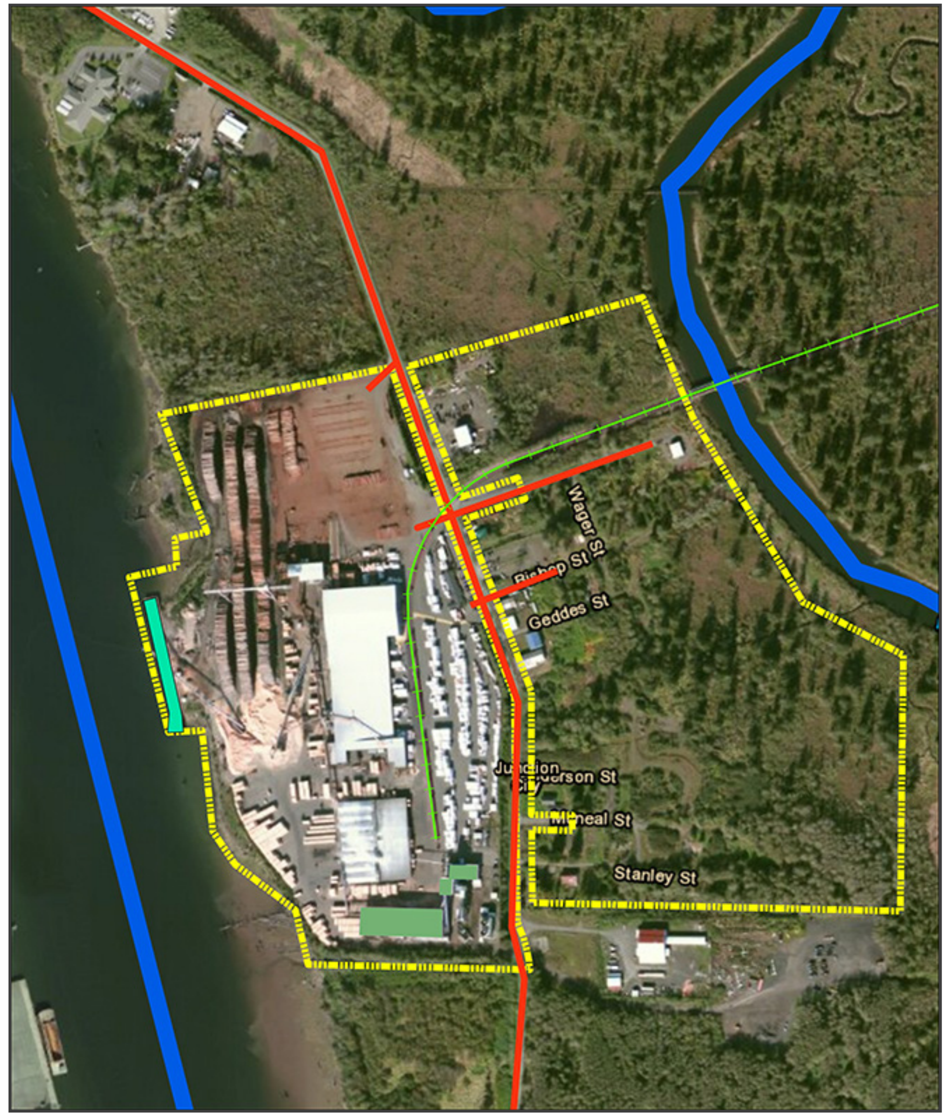

Figure 3.4.1. Site map for Sierra Pacific Industries

3.4.2 SPI SITE OPPORTUNITIES & CONSTRAINTS

This analysis considers the natural, physical and civic attributes for the SPI property. The Sierra Pacific Industries (SPI) sawmill in Aberdeen, WA has several key assets that make it ideal for a solids depot operation. Existing sawmill buildings and equipment, the logyard plus kilns are state of the art, and there is plenty of space to produce post-harvest forest residual feedstock for a liquids depot or an integrated biorefinery facility. Ideally, SPI could continue to run its sawmill operations and co-locate the additional sorting and grinding equipment needed for a solids depot.

The SPI site is currently zoned for heavy industrial use and has 46 acres of undeveloped land that is suited for developing a solids depot without impacting SPI's current lumber mill operations. The SPI property's proximity to the Chehalis River provides for barge transportation to move raw feedstock and deliverable product to customers. When SPI took over site operations in 2001, they invested $2.5-3M to raise the site elevation 10 feet above the base flood level to ensure the site was above the 100-year floodplain.

With several opportunities to accommodate a solids depot, some site constraints were identified: considerable capital expenditures would be required for solids depot construction activities, with special attention to the eastside of the property where a large creek presents potential issues related to riparian habitat and the potential for saturated site soils that would require soil stabilization measures. Considerable investment would also be required to add onsite utilities (e.g. SPI electrical, city water and sewer system) to the undeveloped land. Figure 3.4.2 highlights the site opportunities and constraints of the SPI location.

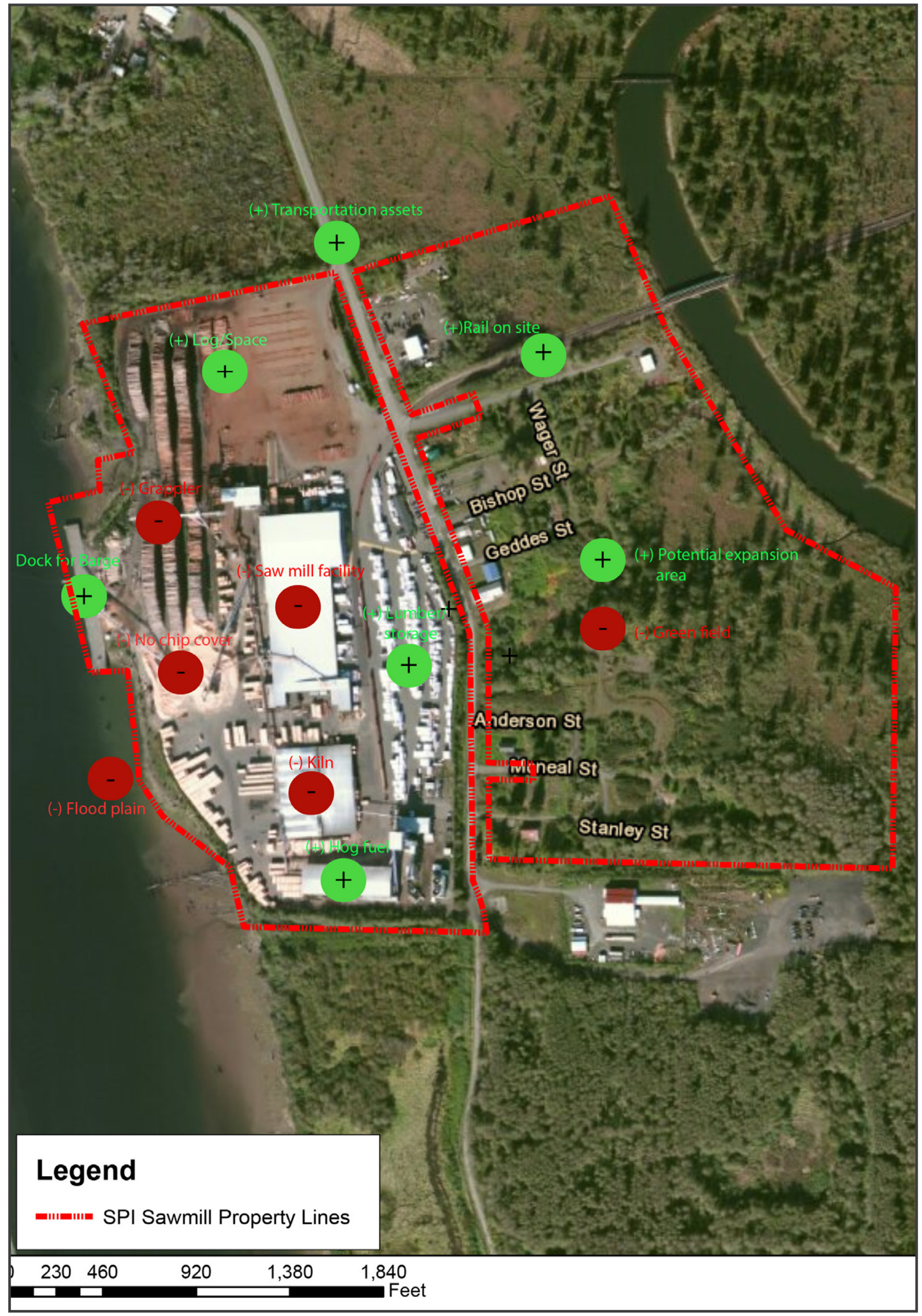

Figure 3.4.2. Sierra Pacific Industries site opportunities and constraints

3.4.3 SPI FINAL DESIGN CONCEPT

The proposed design allows for easy traffic flow in and out of the property. Figure 3.4.3 shows the final design concept. Total land required for the solids depot operations is approximately 6 acres. Incoming trucks will access the site from Highway 12 and proceed south to the SPI site. As trucks enter the site at the southern end, they will turn left. Here feedstock will be offloaded from the trucks on the left side, then the trucks will continue to drive around the perimeter of the site and exit to the north. Trucks picking up solids depot chips will be able to follow the same flow of traffic around the site and pick up chips from the chip storage facility on the north end of the property. A modular building design was chosen for the chipping facility so it could be easily taken down and transported to other locations on the property. The chipping building is also designed so that it can be easily expanded to accommodate increased production.

As a final product, post-harvest forest residual wood chips leave the chipping facility on the north side and are transferred to the chip storage facility. The chip storage build ing is a three-sided structure. A large conveyor belt will be used to transfer the chips from the chipping facility to the clean-chip storage area. The chip-storage structure has an opening facing north to allow for ease of access for trucks transporting chips off site. The processed chips will be transported via chip vans or tractor-trailers to either a liquids depot or an integrated biorefinery for further processing.

Figure 3.4.3. Sierra Pacific Industries solids depot design concept

3.5.0 LIQUIDS DEPOT

A liquids depot processes wood chips into a sugar rich slurry. The facility could accept up to 250,000 BDT of post-harvest forest residues and construction and demolition (C&D) waste and chip the material onsite or could accept processed chips from a solids depot. Additional activities anticipated at the liquids depot include chemical and thermal pretreatment and enzymatic hydrolysis. Pretreatment breaks the bonds that bind cellulose, hemicellulose, and lignin together and exposes the polysaccharides for enzymatic hydrolysis, which generates simple sugars from the cellulose and hemicellulose. A liquids depot would supply an integrated biorefinery with syrup by rail tank car or by a dedicated pipeline. The sugar-rich syrup output from a liquids depot might serve other consumers as well, such as ethanol plants or bio-plastic producers. Lignin-based co-products might also be marketed from this type of depot. Key assets for a potential liquids depot site include:

- Former Kraft pulp/paper facility (digesters)
- On-site boiler and wastewater treatment plants
- Feedstock availability
- Utilities
- Water
- Rail and highway access

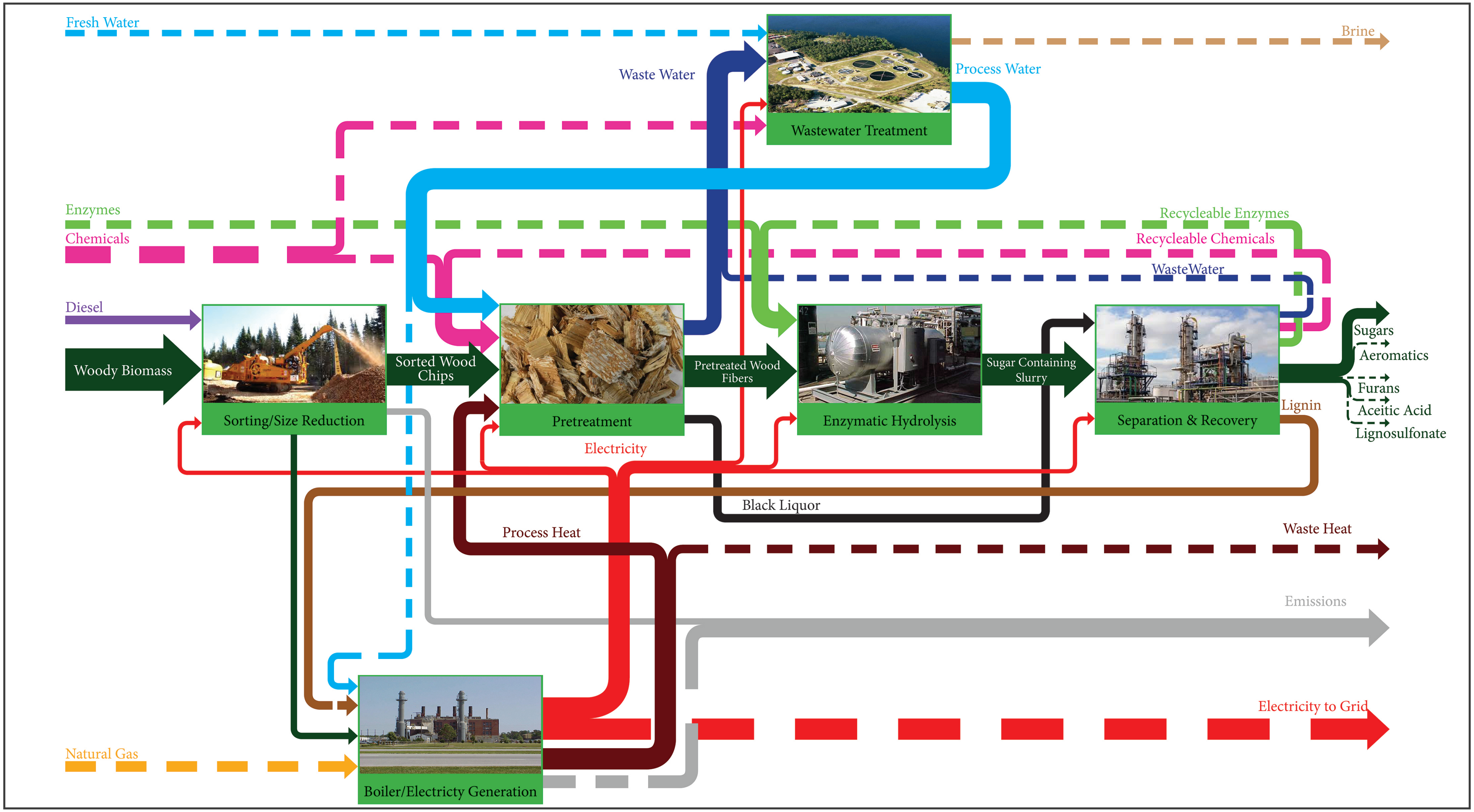

Figure 3.5.1. Liquid Depot Site Processing: process with separation, steam plant, and water treatment facility

3.6.0 KAPSTONE PAPER AND PACKAGING CORPORATION - LONGVIEW, WA

3.6.1 SITE DESCRIPTION

The KapStone Paper and Packaging Corporation (KapStone) operation is located at 300 Fibre Way in the City of Longview (Cowlitz County), Washington, approximately one hour north of Portland, Oregon, and two hours south of Seattle, Washington. The City of Longview has a rich history with timber and paper production and was home to the Longview Fibre Company for 86 years. KapStone, headquartered in Northbrook, Illinois, the leading North American producer of unbleached Kraft paper and corrugated packaging products, purchased the former Longview Fibre facility in 2013.

Currently, KapStone's buildings are fully utilized and operations include: five paper machines that produce approximately 1.4M tons per year (TPY), in addition to multiwall and bag lines that produce 400,000 TPY and a containerboard process that generates 715,000 TPY. For KapStone to expand current operations to include a liquid depot operations, new buildings and equipment would need to be installed onsite.

The wood chips for KapStone's products are delivered to the site by chip van, rail car, and barge. The KapStone property has five docks capable of receiving ocean-going and river barges. KapStone receives approximately 4-5 barges of chips per week for current papermaking operations, and the chips are stored in large piles in the southern portion of the site. The shipping and receiving docks are located on the old mouth of the Cowlitz River. In addition, several rail spurs allow access to the southern, northern and eastern edges of the site that move materials to various storage areas. All the process water, stormwater and wastewater generated by KapStone is treated onsite in conventional wastewater treatment tanks with permitted discharge into the Columbia River.

An undeveloped 40-acre strip of land runs along the western side of the property. This could be a prime location for a liquid depot. A geotechnical investigation has been completed for this parcel, and the land appears suitable for new structures.

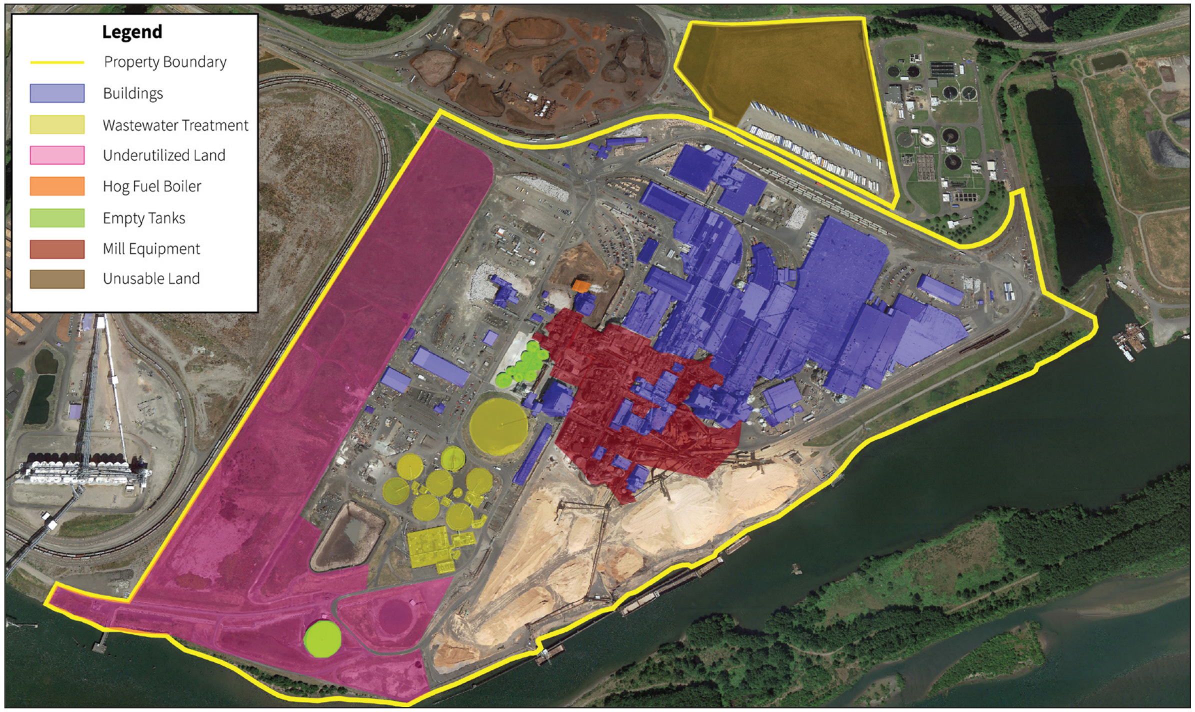

Figure 3.6.1. Site map of Kapstone Paper and Packaging

3.6.2 KAPSTONE PAPER AND PACKAGING SITE OPPORTUNITIES & CONSTRAINTS

Several opportunities and constraints, related to natural, physical, and civic attributes, were identified at the Kapstone site that should be taken into consideration for a potential liquids depot.

KapStone Paper and Packaging bought what was formerly Longview Fibre in 2013 after 86 years of operation. Longview Fibre was greatly valued by the community. The road to the site is called "Fibre Way". Although KapStone bought Longview Fibre Company, the community has continued to accept the industry. "Area leaders welcomed KapStone because of the company's promise to keep the mill running and support more than 1,000 family-wage jobs" (Wagner, 2013). With the positive reception of KapStone, there is an expectation that the addition of a liquids depot component to their operation may also be welcomed.

The KapStone operation presents opportunities to expand the current operations to include a liquids depot operation. There is an undeveloped 40-acre parcel of land along the western site of the KapStone site that is already zoned for heavy industrial use, and is suitable for new industrial structures. In addition, the KapStone site is well serviced by road, rail and barge and this existing infrastructure would be valuable for expanding into the liquids depot production. The KapStone site has good access to both the Cowlitz and Columbia Rivers. Existing process water, wastewater, and stormwater are permitted.

The constraints of the KapStone site are that all the buildings are fully utilized, so any building space required for the addition of a liquid depot will require new construction. Furthermore, even though the site has permits for water and wastewater, the the addition of new liquids depot operations would require the revision of these permits to accommodate the additional demand and discharge. Figure 3.6.2 highlights the site's opportunities and constraints.

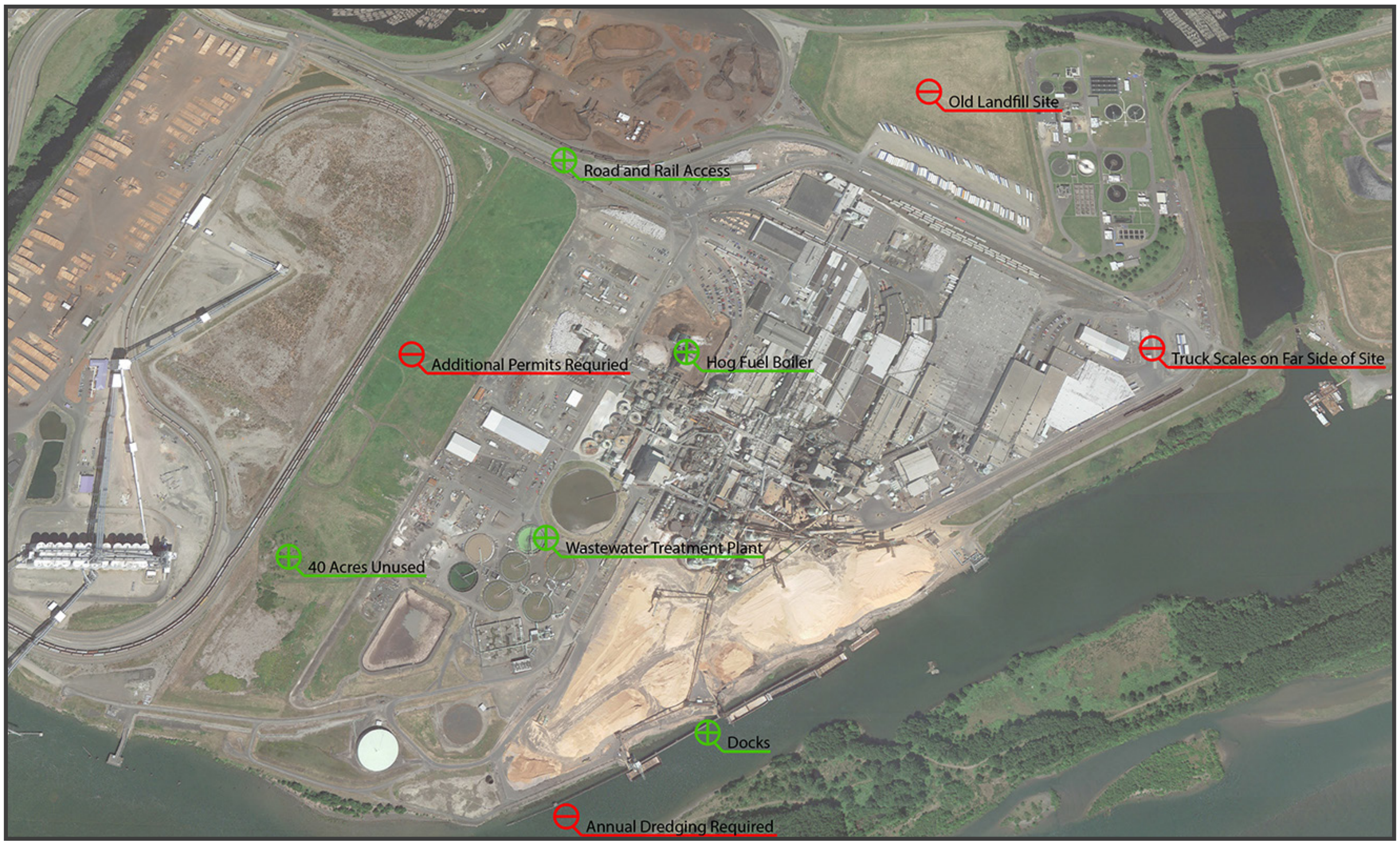

Figure 3.6.2. Kapstone Paper and Packaging opportunities and constraints

3.6.3 KAPSTONE PAPER AND PACKAGING FINAL DESIGN CONCEPT

The final IDX site design concept for the IBR at Kapstone includes the addition of a liquids depot chipping operation placed close to where offsite pulp chip piles are stockpiled. The design places chips as close to the proposed processing areas as possible for efficient materials handling.

The conceptual design complements the liquids depot process by allowing material inputs to flow from the southern portion of the site towards the north as they move through each state of production. Beginning at the bottom of the 40-acre parcel, raw materials will be accumulated and flow linearly through the production stages: pretreatment, hydrolysis, separation and recover. Finally the sugar-rich slurry (product) will be stored onsite until it is transported to a facility for fermentation and refining into a liquid biofuel.

This design takes a minimalistic approach and does not include substantial road and rail additions, which reduces the initial start-up costs but still allows the site to function efficiently. A rail line will need to be added to the far west edge of the Kapstone site, which connects to the log and slash storage areas where incoming biomass can be unloaded from railcars. Trains can also transport the liquid sugars from the site to the next processing destination (e.g. fermentation, refining). A new dock is suggested for the south end of the site which borders the Columbia River. There is currently a small dock here that was previously used to unload oil-based fuels used to power an electrical generation facility. A modern dock in this area would present an opportunity to ship finished sugar-slurry by barge as well as receiving poet-harvest forest residuals or pulp logs for paper or liquids depot processing. Finally, due to the distance from the chipping facility to the liquid depot chip storage area as well as the hog fuel boiler, a large conveyor system will have to be installed, or another solution developed, to move these materials from the chipping area to liquids depot processing area.

Figure 3.6.3. Kapstone Paper and Packaging final design concept

3.7.0 WEYERHAEUSER BAY CITY LOGYARD - ABERDEEN, WA

3.7.1 SITE DESCRIPTION

The former Weyerhaeuser Bay City Logyard is located in the city of Aberdeen, Grays Harbor County, Washington. This site previously served as a Weyerhaeuser owned large-log sawmill, which operated for 81 years until its closure in 2005. The property is largely vacant except for a leased section of land where the Pacific Veneer Mill operates and stores veneer logs. The veneer operation is centrally located onsite, partitioning the property into an “upper” and “lower” yard. The lower yard is approximately 38 acres and the upper yard is approximately 18 acres. The lower yard is accessed from two main entrances on East Perry Street and the upper yard is accessed from North Evans Street. The property is in close proximity to the Port of Grays Harbor.

Figure 3.7.1. Site map of Weyerhaeuser Bay City Logyard

3.7.2 WEYERHAEUSER BAY CITY LOGYARD OPPORTUNITIES AND CONSTRAINTS

Several opportunities and constraints, related to natural, physical, and civic attributes, were identified at the Weyerhaeuser Bay City logyard site that should be taken into consideration for a potential liquid depot. Figure 3.7.2 identifies these for the site.

The Weyerhaeuser Bay City Logyard presents opportunities to be developed into a liquids depot operation. Both the lower and upper portions of the property have enough developable land suitable for a liquids depot facility. The lower site has storm and wastewater systems, a truck scale, shop buildings, and transportation access via road, barge and rail. The lower yard has a dike, which removes it from the 100-year floodplain, and would safeguard against chemical spills entering the river. Additional benefits of the Bay City Logyard site are that the Aberdeen community is welcoming, development offers tax incentives, and a seafaring port is located nearby to support this type of operation.

While the proximity of both the lower and upper yards to the port and river system is an advantage from a transportation perspective, future development on either section would present some social and environmental challenges. The site is close to residential development, sensitive ecosystems, seasonal flooding, and much of it lies in the FEMA-100 year flood area. Specifically, the upper yard is located in the 100-year floodplain, and has Palustrine wetland on site. Furthermore, the upper yard is located near what the City of Aberdeen has designated as a "Waterfront Development Area," which is slated to be developed to serve commercial retail in the near future. This Waterfront Development Area is meant to include establishments such as farmer's markets, restaurants, hotels, motels, or residences, which could be negatively impacted if the design was implemented on the upper yard.

Based on the opportunities and constraints identified at the Bay City Logyard site, the lower yard is the most feasible and practical location for a liquids depot operation.

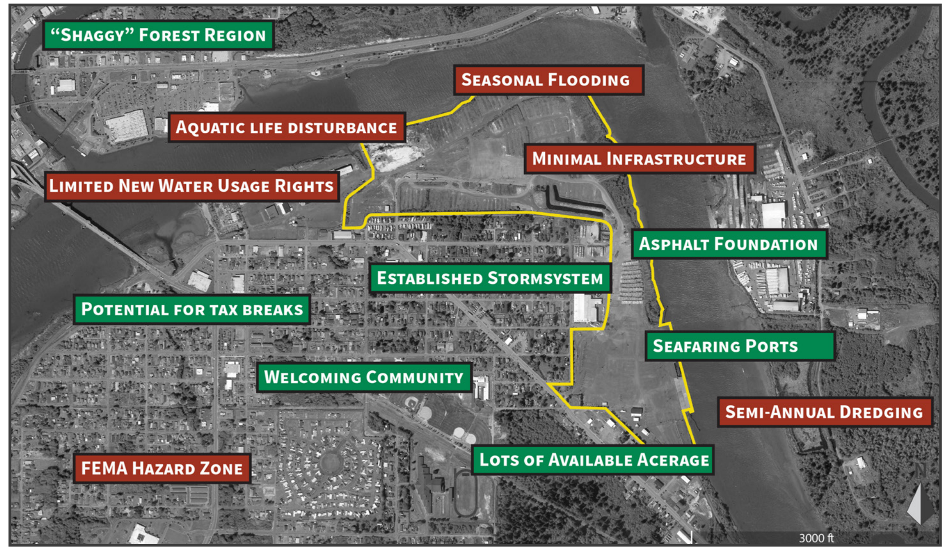

Figure 3.7.2. Weyerhaeuser Bay City Logyard site opportunities and constraints

3.7.3 WEYERHAEUSER BAY CITY LOGYARD FINAL DESIGN CONCEPT

The final IDX design concept for the Weyerhaeuser Bay City lower yard utilizes all existing infrastructure, as well as minimizes the traffic impacts. In addition, the Bay City design concept aligns and orients any new infrastructure with existing processing operations to minimize feedstock, waste, and product conveyance costs. This design concept allows for future upgrades and expansion projects as well as green space to accommodate community recreation opportunities and buffers for natural hazards .

A generic liquid depot operation moves from raw feedstock to mechanical chipping, thermo-chemical pretreatment, enzymatic hydrolysis, and finally separation and recovery. The proposed site infrastructure is designed to follow the liquids depot processing pathway (see Figure 3.7.3). The two pieces of existing infrastructure suitable for a liquids depot are the truck scales and shop building. The existing location of the scales largely determined the on-site flow of traffic. The four-bay shop building is also a valuable asset due to its size and existing equipment, such as pneumatic, welding, and 440-volt setup and connections. Both of these site assets are located along the periphery of the property and are advantageous to the overall site planning.

To minimize traffic throughout the site, feedstock piles (chips and post-harvest slash) are located near the scales and the ports. Port shipping could be incorporated into operations for future expansion possibilities. The overall flow of traffic into and out of the site runs along the outer edge of the liquid depot operations.

This design attempts to reduce overall costs by reducing material handling, and heat and energy losses. The liquid depot plant is centrally located to take in water from the pump house, distribute and collect processing water, and release treated water into the perimeter channel, which is gravity fed back into the Chehalis River. Furthermore, the intensive operations are centrally located to reduce potential noise and glare impacts on nearby residences. The truck scale, breakroom, and office buildings are placed between the depot operations and residential development.

Figures 3.7.4 - 3.7.6 show details for the stormwater system, which will be located on the north, south and west sides of the site. The stormwater system is designed to remove most water impurities. A buffer zone with multiple types of vegetation will be located between the boundary of the lower yard and the residential development. In the southeast corner, an outdoor employee break area is planned for the future.

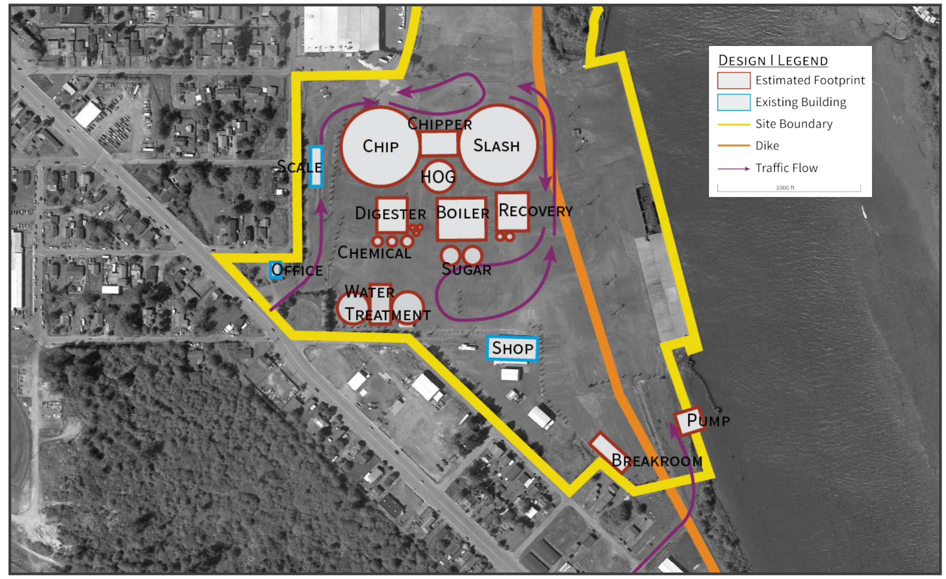

Figure 3.7.3. Weyerhaeuser Bay City Logyard final design concepts for lower yard

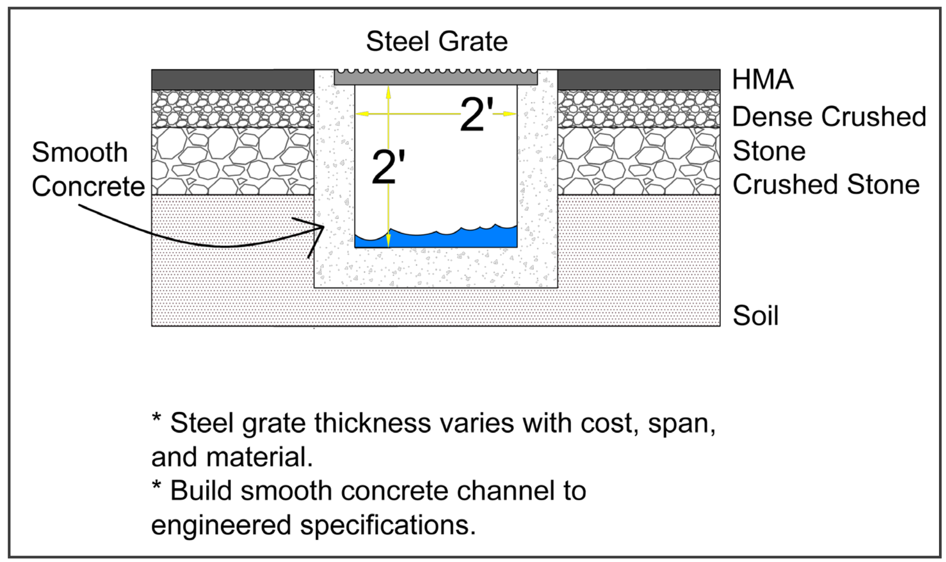

Figure 3.7.4. Weyerhaeuser Bay City Logyard final design stormwater design detail


Figure 3.7.5. Weyerhaeuser Bay City Logyard final design graphic perspective

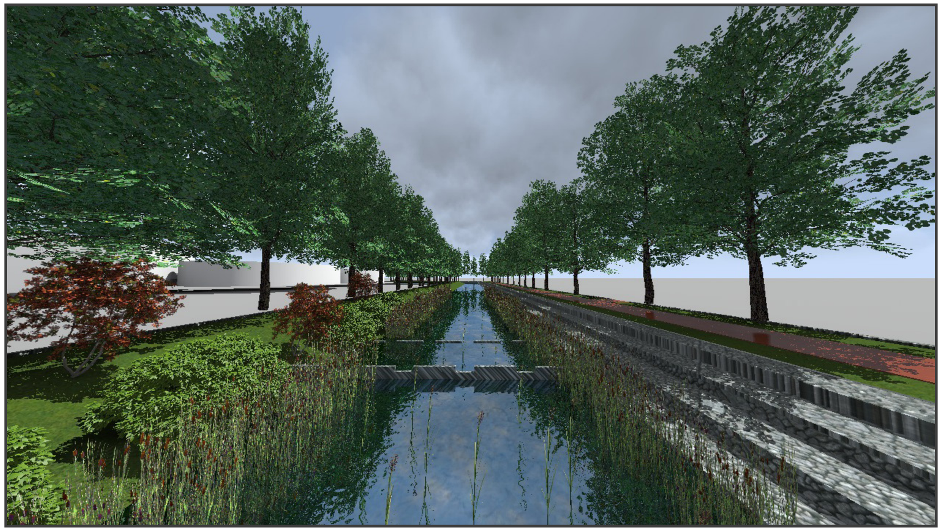
Figure 3.7.6. Weyerhaeuser Bay City Logyard final design graphic perspective

3.8.0 COSMO SPECIALTY FIBERS - COSMOPOLIS, WA

3.8.1 SITE DESCRIPTION

Cosmo Specialty Fibers is a privately-held entity affiliated with the Gores Group. It is located at 1701 1st Street in the the city of Cosmopolis, in the western portion of Grays Harbor County, Washington. The Grays Harbor regional economy has been dominated by the forest products industry (e.g. pulp and paper, sawmills, etc.) for over a century. However, since the 1960's, the county's economy has declined along with these industries. Cosmo Specialty Fibers (Cosmo) re-opened a pulp mill previously owned by Weyerhaeuser which was closed in 2011. The current facility owned by Cosmo serves as a dissolving wood pulp sulfite mill producing 140,000 tons annually of high-alpha pulp bales and rolls that serve as feedstock for a wide variety of products. Cosmo's process converts hemlock chips into dissolving fiber for export to Asian markets. Cosmo burns their wood waste onsite for fuel. Currently, Cosmo is investigating a pilot scale approach to use residual streams from their mill operations to produce cellulosic-based biochemical products.

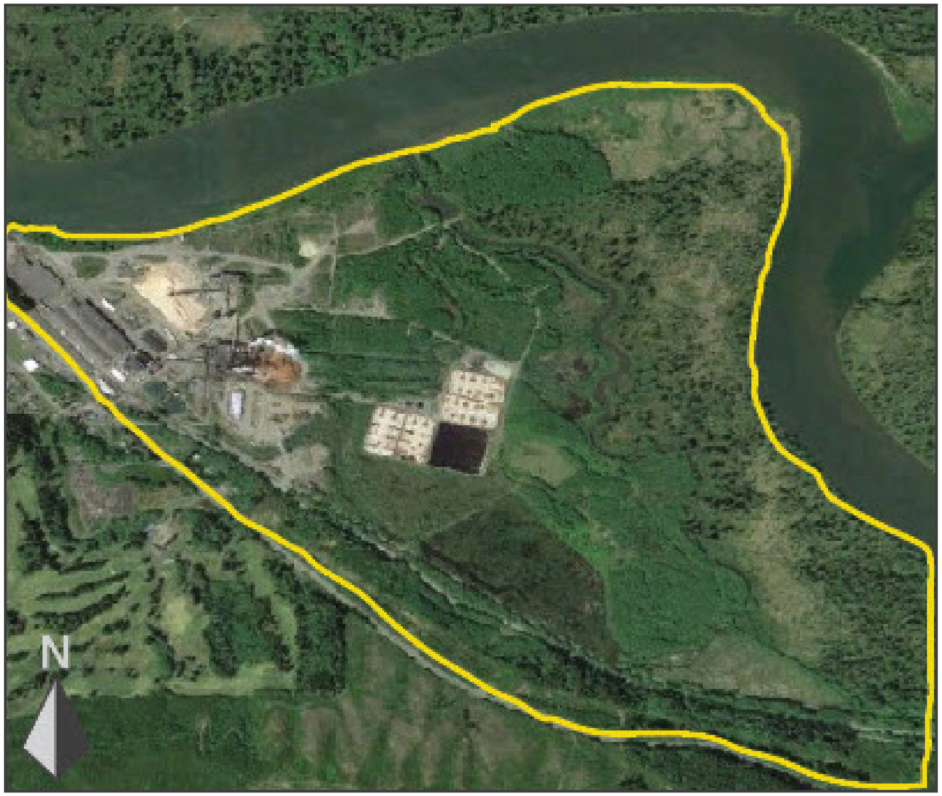

Figure 3.8.1. Cosmo Specialty Fibers site location map in Cosmopolis, WA

3.8.2 COSMO IBR SITE ANALYSIS - OPPORTUNITES AND CONSTRAINTS

The Cosmo site has several opportunities and a few constraints when considering the site for an integrated biorefinery (IBR). Natural, physical and civic attributes of the site were considered when evaluating opportunities and constraints, which are presented in Figure 3.8.2.

Onsite assets include an old and new warehouse, digesters and paper machines, cogeneration facilities, water tower, hog fuel storage area, chip storage area, and a mothballed chipping facility that could be re-tooled. Additional opportunities include an existing infrastructure that uses a bisulfite process that could be transi-tioned to the pre-treatment process developed by NARA. In addition, Cosmo is well positioned to extract and sell cellulosic sugars and other bio-chemicals processed from the mill's red liquor waste stream. These materials are currently being burned; they are rich in sugar and available for fermentation with little additional processing.

Cosmo's close proximity to vacant Weyerhaeuser property just two miles northwest of the site could potentially be repurposed into a solids depot to provide feedstock to an IBR located at the Cosmo site (the Bay City Logyard reviewed in section 3.7 of this report). Both the Cosmo and the Weyerhaeuser property are centrally located to available post-harvest forest residuals generated in the region. Finally, as a NARA affiliated organization, Cosmo is interested in exploring options for increasing value to their waste liquors and considering the potential of adding a biorefinery business model to their operation.

Three significant site constraints were observed at the property: 1) the presence of saturated soils, which could limit building and equipment expansion onto much of the property, 2) Cosmo's current hemlock process does not lend itself well to taking in in less expensive biomass feedstocks (e.g ponderosa pine, Douglas-fir, etc.) and 3) the challenge to continue pulping operations efficiently while simultaneously transitioning from a 100% pulp mill into a biorefinery operation. This might be overcome through the development of a flexible feed handling system, which could allow multiple feedstocks to be handled without contaminating hemlock feedstock that is used for their pulping operation.

Regardless of these challenges, Cosmo has already completed lab bench testing, a market analysis, and evaluated the initial processing costs associated with adding a biorefinery operation to its site. They are continuing to examine a potential product diversification strategy in 2015/2016.

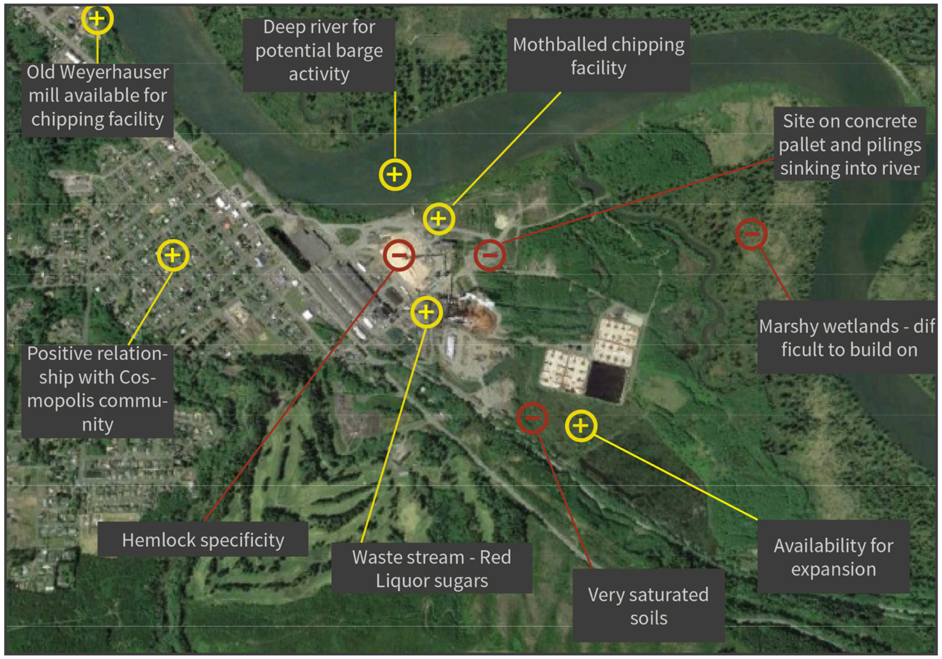

Figure 3.8.2. Cosmo Specialty Fibers opportunities and constraints

3.8.3 COSMO IBR FINAL DESIGN CONCEPT

The final site design builds upon Cosmo's existing facilities and layout (see Figures 3.8.3 and 3.8.4). The southeastern-most section of the Cosmo property was deemed buildable (above 100-year floodplain) and could accommodate IBR infrastructure for the pretreatment, enzyme hydrolysis, fermentation, distillation, refining, and product distribution stages with little site prep. An expanded biomass chipping facility (e.g., solids depot) is proposed for the vacant Weyerhaeuser property, which is approximately two miles northwest of Cosmo. The proposed IBR is near the highway for shipping and receiving activities. Site products would be distributed from the IBR at a location just across a bridge from the main processing facility.

Figure 3.8.5 features a preliminary design for future stormwater treatment for the proposed IBR facility. The conceptual design assumes that current cogeneration operations, water and wastewater facilities, and electric facilities would be adequate for the proposed IBR.

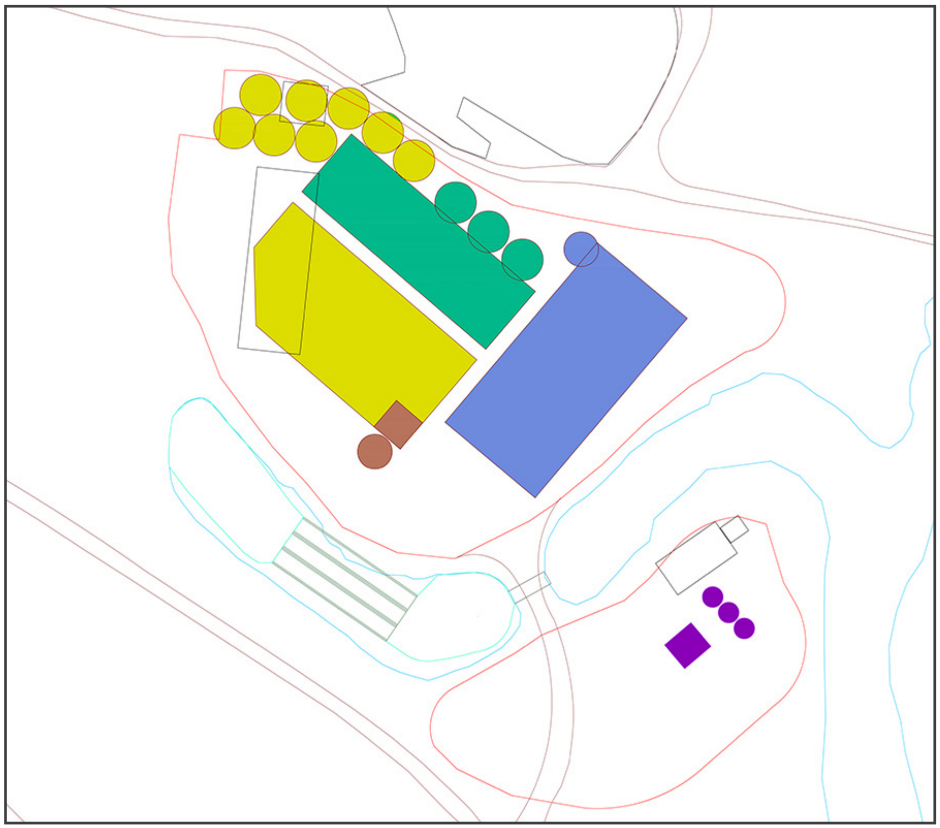

Figure 3.8.3. Cosmo Specialty Fibers final design concept

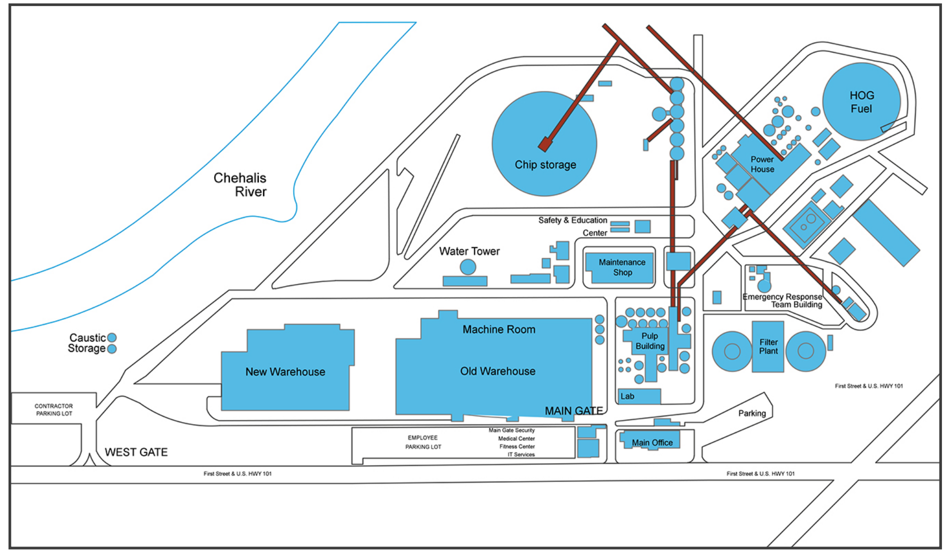

Figure 3.8.4. Cosmo Specialty Fibers final design concept

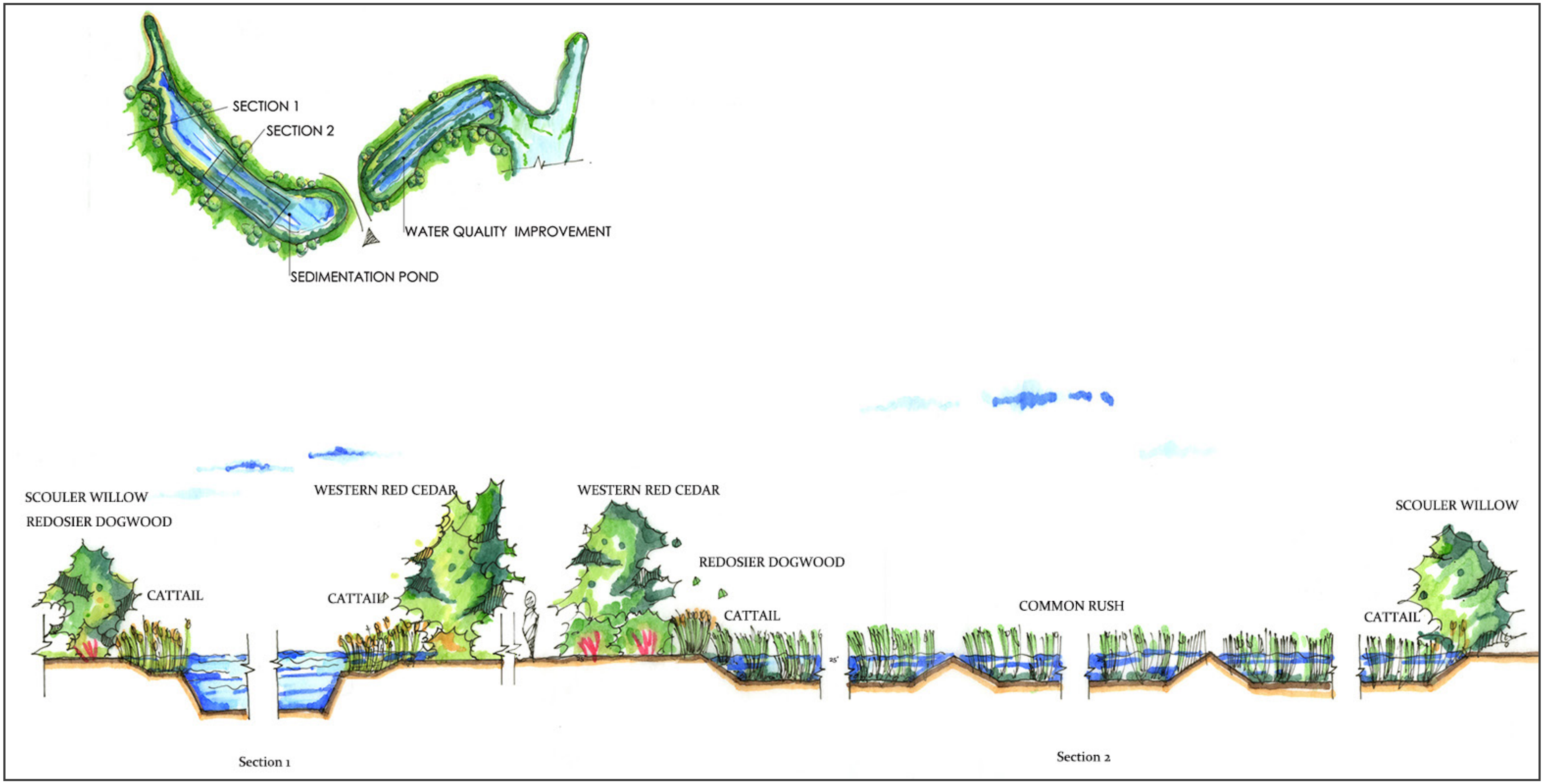

Figure 3.8.5. Cosmo Specialty Fibers final design concept

3.9.0 CONCLUSION

This report is the final of three produced for the Mid-Cascade to Pacific (MC2P) region. The first report, the MC2P Profile, outlines the goals for the supply chain study and the methods used. The second report, the MC2P Analysis, describes the supply chain analysis and site selection process the IDX team took to identify suitable locations for solids and liquids depots and IBRs. This final volume shows site designs for facilities identified through the site selection process. The section of the report show facilities that could co-locate solids or liquids depots onsite in conjunction with their existing operations. The final design shows the potential for Cosmo to add an IBR to their site, as a way to diversify the products made at their site. All of these reports are available at the WSU Research Exchange: https://research.libraries.wsu.edu/xmlui/handle/2376/5661.