DOE/EA-1888

ENVIRONMENTAL ASSESSMENT

FOR THE

OLD TOWN FUEL AND FIBER PROPOSED DEMONSTRATION-SCALE INTEGRATED BIOREFINERY, OLD TOWN, MAINE

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office
Golden, Colorado

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ACRONYMS AND ABBREVIATIONS

ºF	degrees Fahrenheit
BACT	Best Available Control Technology
BOD	biochemical oxygen demand
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DPS	Distinct Population Segment
EA	Environmental Assessment
EISA	Energy Independence and Security Act of 2007
EPA	U.S. Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FOA	Funding Opportunity Announcement
FWS	U.S. Fish and Wildlife Service
HRSG	heat recovery steam generator
MBTA	Migratory Bird Treaty Act
MEDEP	Maine Department of Environmental Protection
MDIFW	Maine Department of Inland Fisheries and Wildlife
MEPDES	Maine Pollutant Discharge Elimination System
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
OTFF	Old Town Fuel and Fiber
PM_{10}	particulate matter with a diameter equal to or greater than 10 microns
SCR	Selective Catalytic Reduction
SPCC	spill prevention control and countermeasures
SWPPP	stormwater pollution prevention plan
U.S.C.	United States Code
U.S.	United States
WET	whole effluent toxicity

1. INTRODUCTION

Under the Energy Policy Act (EPAct) of 2005, the United States (U.S.) Congress directed the U.S. Department of Energy (DOE) to carry out a program to demonstrate integrated biorefineries for the production of transportation fuel from lignocellulosic feedstocks. Federal funding for lignocellulosic fuel production facilities is intended to further the government's goal of rendering lignocellulosic fuel cost-competitive with fossil fuel by 2012 and, along with increased automobile fuel efficiency, reducing fossil fuel consumption in the United States by 20 percent within 10 years.

In May 2007, pursuant to Section 932 of EPAct 2005, DOE issued a Funding Opportunity Announcement (FOA) for applications to design, construct, build, and operate/validate an integrated biorefinery demonstration employing terrestrial lignocellulosic feedstocks for the production of some combination of (1) liquid transportation fuel(s) that is a fungible replacement for liquid transportation fuels currently used in the existing infrastructure, (2) biobased chemicals, and (3) substitutes for petroleum-based feedstocks and products. The objective of this FOA was to support demonstrations that would validate key process metrics and provide the kinds of continuous operational data at the scale needed to lower the technical risks associated with financing a future commercial plant. Red Shield Acquisition, LLC (a subsidiary of Old Town Fuel and Fiber; hereinafter OTFF) applied to the FOA, and was selected to negotiate for an award of financial assistance to help design, construct, and operate a demonstration-scale biorefinery at the existing pulp mill in Old Town, Maine.

DOE has authorized OTFF to expend federal funding for preliminary activities, including final engineering design, the completion of this Environmental Assessment (EA), permitting, and pilot-scale testing. These activities are associated with the proposed project and do not significantly impact the environment or represent an irreversible or irretrievable commitment of federal funds in advance of the conclusion of this EA. DOE is currently proposing to authorize the expenditure of federal funding for OTFF to complete final design, construct, and initially operate the OTFF demonstration-scale integrated biorefinery.

DOE is proposing to authorize the expenditure of $30 million of federal cost-share funding to OTFF to support the final design, construction, and startup of a demonstration-size biorefinery to produce n-butanol from lignocellulosic (wood) extract. When operating, the facility would annually produce the following saleable products: 1.36 million gallons of n-butanol, 2.29 million gallons of acetic acid, 815,000 gallons of formic acid, and 401,000 gallons of acetone. This project would be used to demonstrate the technical and economic feasibility of converting wood extract to n-butanol. The proposed project would be entirely within the boundaries of the existing pulp mill on approximately 180 acres, with most of the proposed project infrastructure in the former tissue mill. The proposed project also includes use of the OTFF wastewater treatment plant, which is on approximately 23 acres of OTFF-owned land adjacent to the pulp mill. The wastewater treatment system consists of an aeration pond, spill pond, four clarifiers, and a control building. The total anticipated cost of the proposed project is approximately $76 million, and if DOE were to authorize expenditure of the $30 million federal cost share, OTFF would be responsible for the remaining project costs.

Federal funding of projects requires compliance with the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] 4321 et seq.); Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); and DOE NEPA implementing procedures (10 CFR Part 1021). Therefore, DOE prepared this environmental assessment (EA) to evaluate the potential environmental consequences of authorizing expenditure of federal funds. In compliance with NEPA and its implementing procedures, this EA examines the potential environmental consequences of the DOE Proposed Action (under which DOE would authorize OTFF to expend federal funds) and the No-Action Alternative (under which it is assumed that, as a consequence of

DOE denying financial assistance, OTFF would not proceed with the project). The purpose of this EA is to inform DOE decision makers, other agencies, and the public of the potential environmental consequences of the proposed project and alternatives.

1.1 Purpose and Need for Agency Action

In compliance with the statutory mandate of Section 932 of EPAct 2005, DOE has implemented a program to demonstrate the commercial application of integrated biorefineries that produce ethanol from cellulosic feedstocks. The biorefinery that would be constructed and operated as a result of the Proposed Action would meet the requirements of Section 932 by using renewable supplies of biomass, primarily wood and wood waste, to produce fuel-grade ethanol. The Proposed Action would support the DOE mission to reduce dependency on fossil fuels and commercialize cellulosic technologies. By providing financial assistance to support construction of the proposed biorefinery, DOE would support national energy needs and the development of alternative fuel sources.

1.2 National Environmental Policy Act and Related Procedures

In accordance with DOE and Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) implementing regulations, DOE is required to evaluate the potential environmental impacts of DOE facilities, operations, and related funding decisions. The proposal to use federal funds to support the OTFF proposed demonstration-scale biorefinery project requires that DOE address NEPA requirements and related environmental documentation and permitting requirements. In compliance with NEPA (42 United States Code [U.S.C.] 4321 et seq.) and DOE NEPA implementing regulations (10 Code of Federal Regulations [CFR] Parts 1021 and 1022) and procedures, this Environmental Assessment and notice of wetland involvement (EA) examines the potential environmental impacts of the DOE Proposed Action and the No-Action Alternative. This EA also addresses the requirements of Section 106 of the National Historic Preservation Act of 1966 (NHPA) revised regulations, Protection of Historic Properties (36 CFR Part 800), which became effective January 11, 2001.

Although this project could proceed if DOE decided not to provide financial assistance, DOE has assumed, for the purposes of comparison in this EA, that the project would not proceed without DOE assistance. If the project proceeded without DOE assistance, the potential impacts would be essentially identical to those under the DOE Proposed Action (that is, providing assistance that enables the project to proceed). This EA analyzes the potential environmental and socioeconomic impacts that would result from implementing the Proposed Action (with DOE funding) and the No-Action Alternative (without DOE funding), and evaluates the potential individual and cumulative effects of the Proposed Action

1.3 Public Scoping

In accordance with applicable regulations and policies, DOE sent scoping letters to potentially interested local, state, and federal agencies, including the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), the Maine Department of Environmental Protection (MEDEP), the Maine Department of Conservation, the Maine Department of Transportation, and the Maine Historic Preservation Commission. DOE also sent scoping letters to other potentially interested individuals and organizations, including the Penobscot River Restoration Trust (hereinafter Penobscot Trust). DOE published the scoping letter on line at the Reading Room of its Golden, Colorado, Field Office (http://www.eere.energy.gov/golden/Reading_Room.aspx). The scoping letter described the Proposed Action and requested assistance in identifying issues the EA might evaluate. Appendix A contains a copy of the scoping letter distribution list and Notice of Scoping. No comments were received during the public scoping period

In addition, DOE initiated consultations with the FWS, the NMFS, the Maine Historic Preservation Commission, the Penobscot Indian Nation, the Aroostook Band of Micmac Indians, the Houlton Band of Maliseet Indians, the Passamaquoddy Tribe, and the Pleasant Point Reservation of the Passamaquoddy. Appendix B contains a copy of the consultation letters and responses.

The proposed project is currently undergoing a Site Plan Review under the City of Old Town Zoning Ordinance. As part of this process, there will be a public hearing on the project on August 9, 2011. Residents adjacent to the pulp mill will be notified of this public hearing.

1.4 Content and Environmental Resources Not Carried Forward

Chapter 2 of this EA describes the DOE Proposed Action, provides details about the proposed project, and describes the No-Action Alternative. Chapter 3 details the affected environment and potential environmental consequences of the Proposed Action and the No-Action Alternative, and Chapter 4 addresses cumulative impacts. Chapter 5 lists the references for this document.

Chapter 3 examines the following environmental resource areas:

- Land use
- Water resources
- Biological resources
- Air quality
- Aesthetics
- Safety and occupational health
- Waste management and hazardous materials
- Utilities
- Cultural resources
- Traffic
- Socioeconomics and environmental justice

In addition, DOE EAs commonly address the environmental resource areas listed in Table 1-1. However, in an effort to streamline the NEPA process, DOE is not examining the areas in the table at the same level of detail as the resource areas listed above. Table 1-1 provides the DOE screening evaluation of these other resource areas. In each case, DOE anticipates no impacts; therefore, DOE determined that further analysis would not be necessary. Under the No-Action Alternative, the impacts would not occur because DOE assumes the proposed project would not proceed.

Table 1-1. Environmental Resource Areas not Analyzed

Environmental Resource Area	Impact Consideration and Conclusions
Noise	The proposed project would be installed in an existing building on a site with existing industrial operations and associated noise. There would be temporary noise generated during construction. During operations, the noise generated from the biorefinery would be typical of other noise generated on the site and is not expected to be above existing ambient noise levels.
Geology and soils	Onsite soils are already disturbed. There would be no actions that would result in impacts to geology or that would be unduly affected by geological instabilities. The proposed project would be installed in an existing building and not result in any change to the topography of the site. The installation of six storage tanks and a cooling tower cell outside the former tissue mill would require grading of the already disturbed area to prepare the storage tank foundations, spill containment and drainage control, and paving activities. It is expected that this new construction outside of the former tissue mill would require approximately 0.5 acre.

2. PROPOSED ACTION AND ALTERNATIVES

As required by federal regulation, this EA addresses the possible environmental impacts of the Proposed Action and the No-Action Alternative. Section 2.1 discusses the Proposed Action. Section 2.2 describes the No Action Alternative activities that would occur if DOE does not authorize the expenditure of federal funds for the proposed project.

2.1 Proposed Action

The DOE Proposed Action is to authorize the expenditure of federal funding (up to $30 million) for OTFF to design, construct, and initially operate an integrated biorefinery in Old Town, Maine.

DOE has authorized OTFF to expend federal funding for preliminary activities, including final engineering design, the completion of this EA, permitting, and pilot-scale testing. These activities are associated with the proposed project and do not significantly impact the environment or represent an irreversible or irretrievable commitment of federal funds in advance of the completion of this EA.

The Proposed Action consists of final design, construction, and startup of a demonstration-size biorefinery to produce n-butanol from lignocellulosic (wood) extract. OTFF is proposing to install and operate a demonstration-scale biorefinery at their existing pulp mill in Old Town, Maine, to demonstrate the production of n-butanol from wood extract (see Figure 2-1). When operating, the facility would annually produce the following saleable products: 1.36 million gallons of n-butanol, 2.29 million gallons of acetic acid, 815,000 gallons of formic acid, and 401,000 gallons of acetone. This project would be used to demonstrate the technical and economic feasibility of converting wood extract to n-butanol. The proposed project would be entirely within the boundaries of the existing pulp mill, which is on approximately 180 acres; most of the proposed project infrastructure would be in the former tissue mill (see Figure 2-2). It should be noted that the existing pulp mill design would allow for tissue production in the future, even if the proposed project were installed and operational at the site.

The pulp mill currently converts wood chips into pulp in the form of thick fiber boards using a common method called the Kraft pulping process. The pulp is then sold to paper manufacturers for further processing. The pulp mill has been operating since the mid 1960s. Before use as a Kraft mill, the pulp mill had been operated as a chemical pulp mill since 1882. From the early 1970s until 2005, the mill site also operated a tissue mill.

The proposed biorefinery would produce n-butanol from wood chips by extracting hemicelluloses before the Kraft pulping process, and would use portions of the existing Kraft process and on-site pulp mill infrastructure and utilities. Figure 2-3 shows the site layout of the pulp mill along with the proposed biorefinery and associated infrastructure.

The objectives of the proposed project are to operate the biorefinery systems to:

- Validate the technology for future commercial-scale applications
- Validate the economics for future commercial-scale applications
- Establish the metrics for replication of the technology at other locations

Figure 2-1. Site Location Map

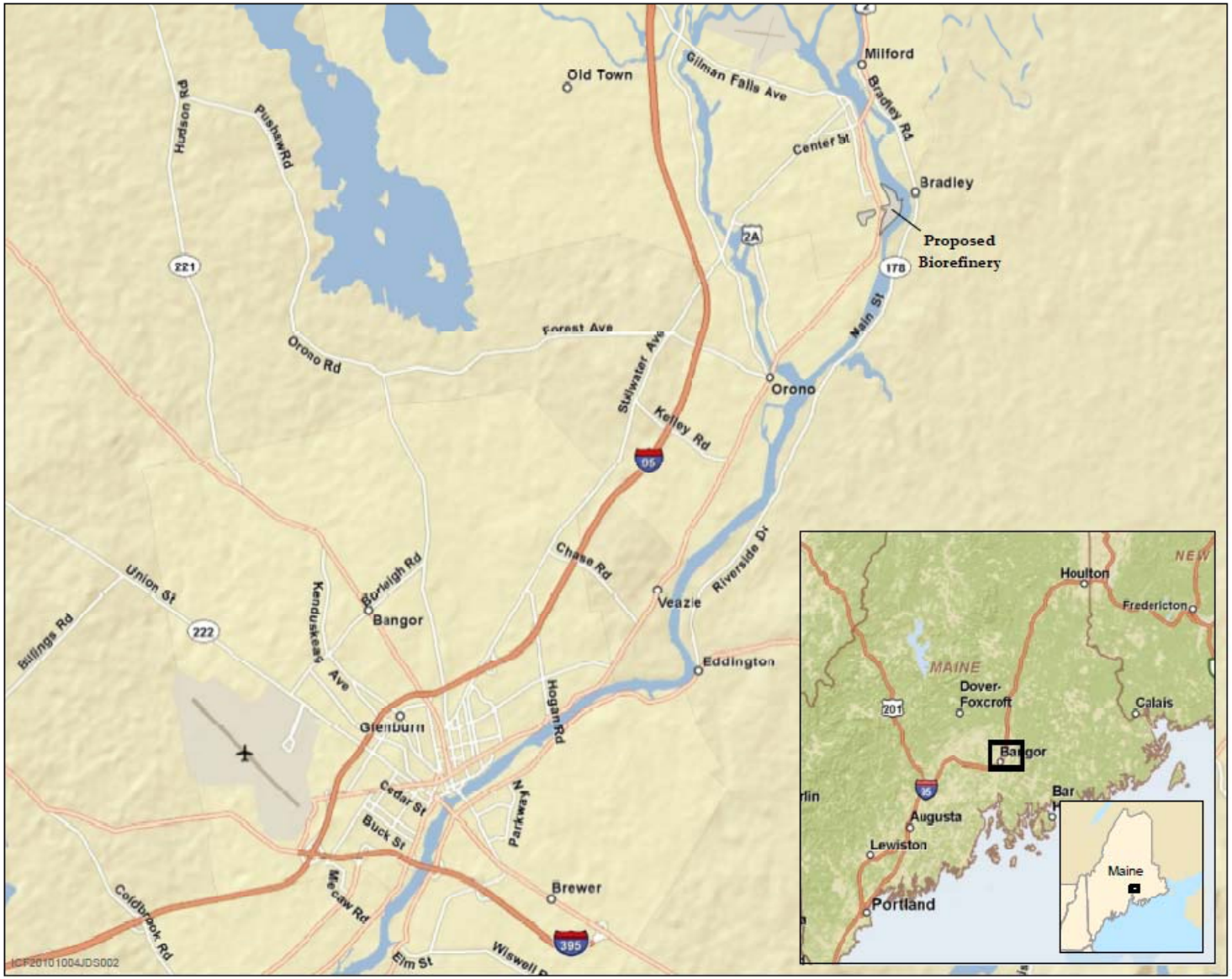


Figure 2-2. Old Town Fuel and Fiber Aerial Photo

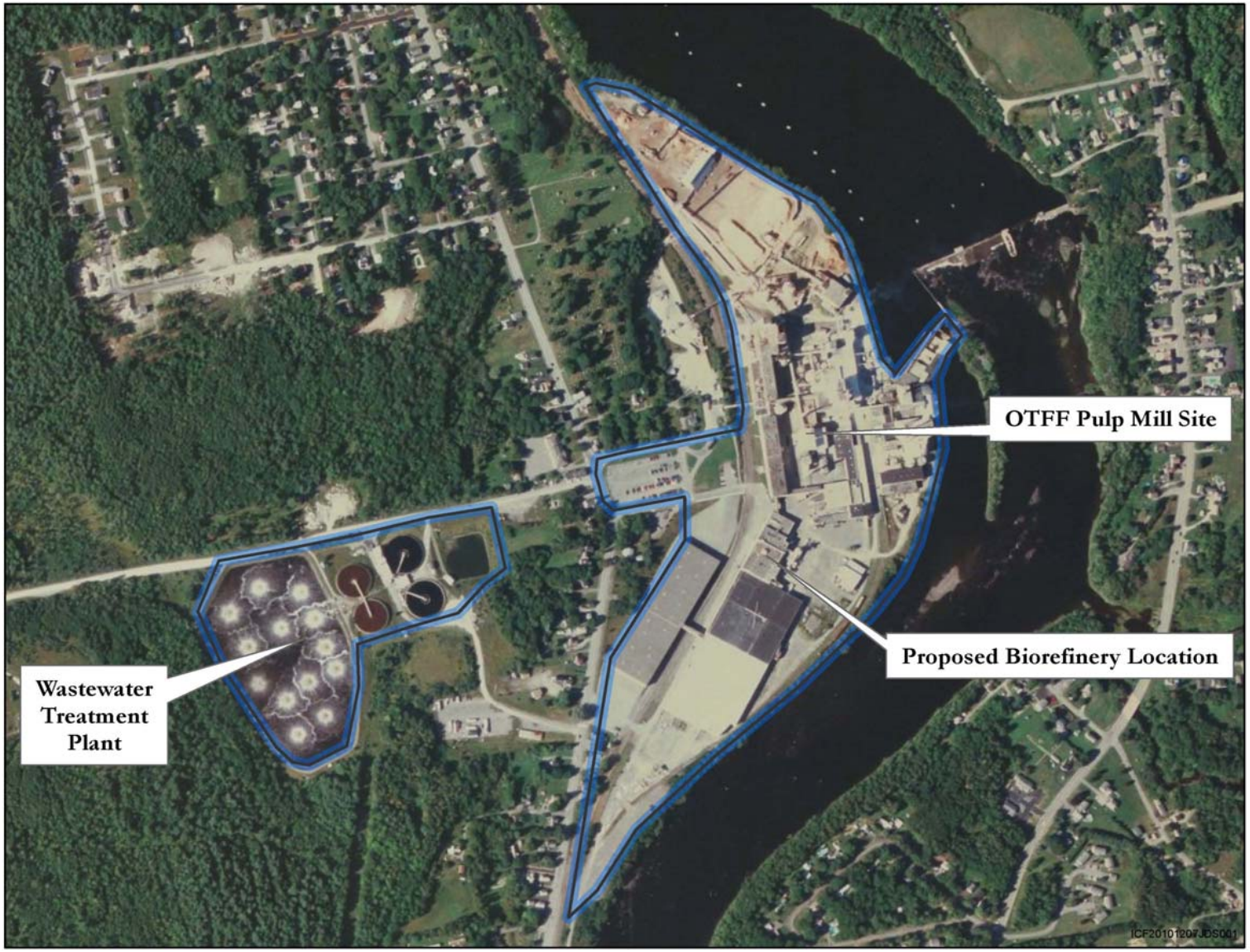
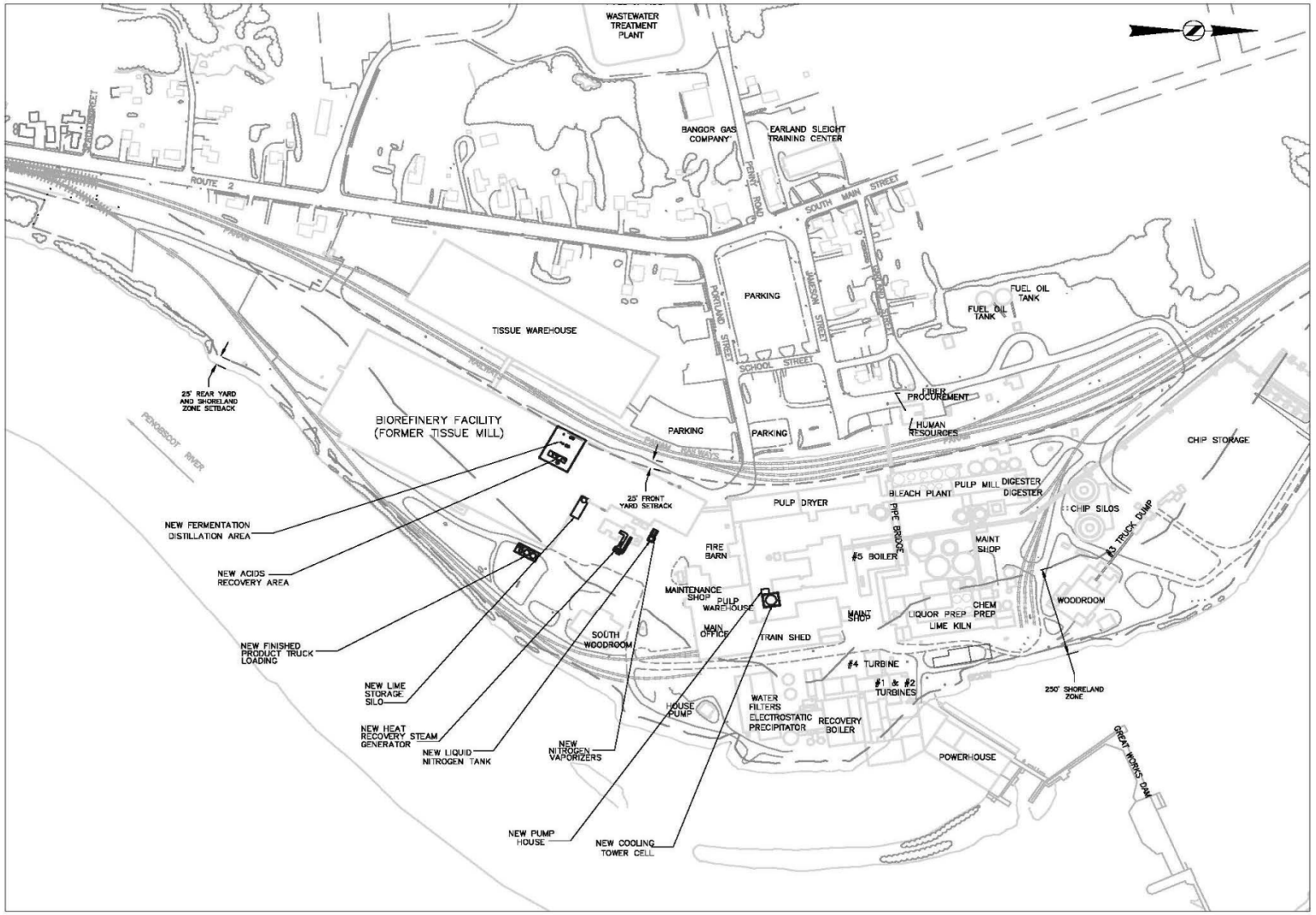


Figure 2-3. Site Layout



2.2 Project Location and Site Plan

The proposed project site is within the boundaries of the existing pulp mill at 24 Portland Street, Old Town, Penobscot County, Maine (approximately 120 miles northeast of Portland and 15 miles north of Bangor) (see Figure 2-1). OTFF owns the property, which is currently zoned for industrial use.

OTFF operates the pulp mill, which is on a bend on the western side of Penobscot River (see Figure 2-2). The site is approximately 180 acres that extends from the chip storage and conveying facility at the northern end to the former tissue converting and warehouse facilities at the southern end. The property is bounded on the east by Penobscot River and on the west by South Main Street. Current operations at this property include chip storage and handling, pulping, bleaching, drying, pulp manufacturing, maintenance, warehousing, fuel storage, and black-liquor storage. The OTFF wastewater treatment plant is directly west of the pulp mill across South Main Street along Penny Road on approximately 23 acres of OTFF-owned land. The wastewater treatment system consists of an aeration pond, spill pond, four clarifiers, and a control building (see Figure 2-2).

2.2.1 Process Description

The proposed biorefinery would use a number of different unit operations to produce n-butanol, acetic acid, formic acid, and acetone. The basic components of the process would be as follows:

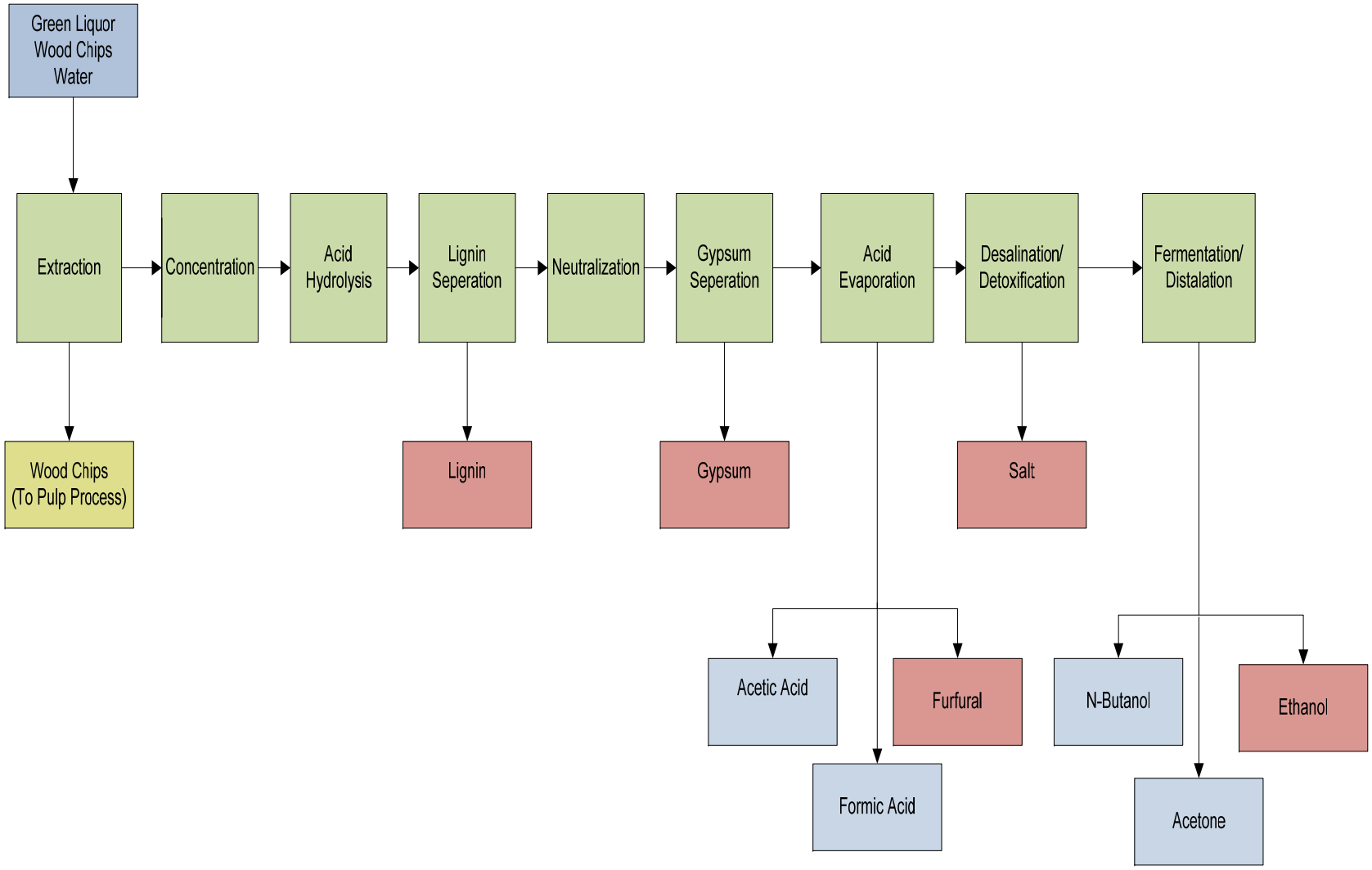
- Feedstock pretreatment/hydrolysis
- Concentration
- Acid hydrolysis
- Lignin separation
- Neutralization, gypsum separation
- Acid recovery
- Desalinization
- Fermentation
- Distillation

See Figure 2-4 for the process flow chart.

2.2.1.1 Feedstock Pretreatment/Hydrolysis

The feedstock for the biorefinery would be commercial mixed northeast deciduous woodchips (birch, beech, and maple). No additional feedstock would be purchased for the biorefinery beyond what is currently used at the pulp mill. Woodchips are currently processed via mixing with white liquor as part of the Kraft pulping process. White liquor is a water solution of sodium sulfide and sodium hydroxide. The purpose of the white liquor is to chemically dissolve the lignin that binds the cellulose fibers (EPA 2011a). Lignin is a glue-like substance that keeps plant cell walls from falling apart; it needs to be removed so that long chains of sugars can be extracted from the wood chips to form simple sugars. For the biorefinery, a processing step would be added to produce extract; this extraction step would take place at the existing pulp mill in an existing extraction vessel. The feedstock flow to the extraction vessel is currently 1,200 metric tons per day (dry basis) of screened wood chips. The chips currently travel from chip bins to a steaming vessel, where they are heated to approximately 145 degrees Fahrenheit (ºF). From the steaming vessel, the chips would be mixed with green liquor (a mixture of washing soda and sodium sulfide produced as part of the Kraft pulping process) and water and pumped to the existing extraction vessel. Green liquor is used to extract hemicelluloses (a long molecule of connected sugars that is part of the plant cell wall) from the woodchips. The chips and green liquor would be heated to 335 ºF using an

Figure 2-4. Process Flow Chart



injection heat exchanger. The high temperature causes a breakdown of chemicals in the wood chips, known as autohydrolysis. Natural acids in the wood are released, allowing for the extraction of hemicelluloses. This process produces extract that is primarily hemicelluloses, acetic acid, formic acid, furfural, and lignin.

Before the concentration step, the pH (a measure of the acidity of an aqueous solution) of the extract would be raised to neutral to preserve organic acids in the extract. The extract from the partially processed chips would be sent via pipeline to the biorefinery for further processing. This pipeline would be part of a series of new aboveground pipelines that deliver products to and from the biorefinery. The pipelines would be housed in the existing pipe bridge (see Figure 2-5). The partially processed chips would then be delivered to the existing pulp mill to be processed into Kraft pulp. A 1-percent decrease in volume of woodchips being processed into pulp is expected due to the addition of the biorefinery.

2.2.1.2 Concentration

The extract would be sent via pipeline from the extraction vessel to the initial evaporators in the biorefinery. Here, the extract would be evaporated to increase the solids from 6 percent to 22 percent, and a surface condenser would condense all vapors. During this process, 88 gallons per minute of condensate contaminated with sulfur-containing compounds would be collected and pumped to the foul condensate tank in the pulp mill bleach plant, where it would be combined with condensates from the existing pulp mill evaporators. From there, it would be pumped directly to the wastewater treatment plant's aeration basin. Gases that pass through the condenser and are not condensable would be piped into the existing non-condensable gas systems to be burned with the mill's other gases to recover the heat value.

2.2.1.3 Acid Hydrolosis

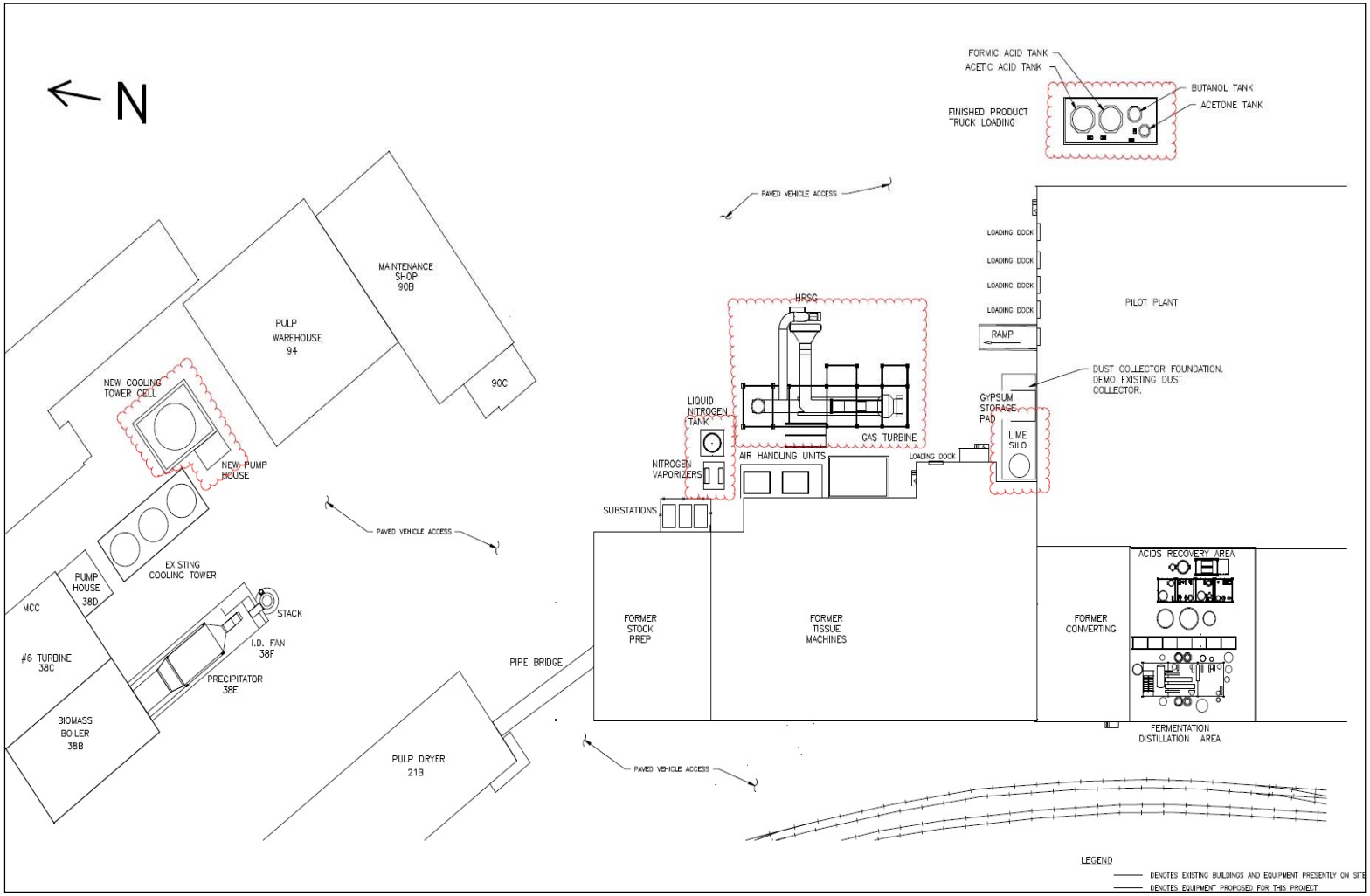
The purpose of the acid hydrolysis step is to break the hemicellulose, a long molecule of connected sugars, into smaller sugars to facilitate a simpler fermentation process. Hydrolysis occurs when the long molecule is broken and a water molecule is added. Lignin is trapped in the mesh of the long-chain polymer sugars and is released during hydrolysis as the molecule is broken up.

Four agitated reactor vessels with heating and cooling jackets would serve as the point for the delivery of the extract; each reactor vessel would have a capacity of 7,500 gallons. A 100,000-gallon storage tank would be used to store the extract before it was sent to the reactor vessels. These vessels would complete the following tasks: heating and cooling of extract, acidifying extract, recirculation of extract, filtering of extract, sampling of extract, and acid hydrolysis. Sulfuric acid (93 percent) would be added to the extract in the reactor vessel until the pH reached 1.0. Steam would then be introduced in the reactor vessel jacket to raise the temperature of the extract to 230 °F to increase the rate of the hydrolysis reaction. Reactor cooling would be utilized to stop the hydrolysis process to avoid production of unwanted by-products (furfural). After this step, the extract would be sent to the 15,000-gallon acid hydrolysis post-storage tank before lignin separation.

2.2.1.4 Lignin Separation

After acid hydrolysis, the extract would be cooled to remove lignin. Lignin would be removed from the extract because it is a fermentation inhibitor. The lignin would be recovered and sent via aboveground pipeline back to the existing pulp mill, where it would be combined with the lignin removed from the pulp in the Kraft pulping process and burned in the boiler to recover the heat value.

Figure 2-5. Location of Tanks



2.2.1.5 Neutralization and Gypsum Separation

In the neutralization vessel, calcium hydroxide (lime plus water) would be added to the hydrolyzed extract to raise the pH from 1 to 2.5. This pH range would allow for the removal of the acetic and formic acids through further evaporation. The reaction between the sulfuric acid and the calcium hydroxide would create gypsum. The gypsum removal step would utilize a centrifuge. Gypsum removal efficiency is expected to be 98 percent. The treated extract would be stored in a tank before evaporation. Excess lime and gypsum would be removed as waste products at a rate of 33.8 dry short tons per day. Waste products, comprised mostly of gypsum, would be sent to a landfill via truck. Chapter 3 addresses the impacts of trucking waste products to a landfill and the effects of gypsum on the landfill.

After gypsum removal, the extract would be pumped to the evaporators with a centrifugal pump sized for the design flow to the second set of evaporators to remove the organic acids from the extract and to increase the concentrations of the sugars in the extract. The organic vapors would be released and condensed in the surface condenser. The condensate would be collected in a tank with a volume of 300 gallons and sent to the acid recovery process.

2.2.1.6 Acids Recovery

The condensate would be processed to separate the acetic acid, formic acid, and furfural using a liquid-liquid extraction process. The acids would be refined to saleable purity through multi-step distillation. After separation, the acids would be sent to storage tanks before shipment to commercial markets. Storage tank capacities would hold up to 7 days of production. Shipments would occur as tanks fill to capacity, but no less frequently than weekly. Expected recovery would be 2.29 million gallons per year of acetic acid. Formic acid would be produced at a rate of 815,000 gallons per year and furfural at a rate of 106,000 gallons per year. Due to the smaller quantities present, furfural would not be sold; rather, it would be sent to the boiler to recover the heat value. Once the biorefinery is operational, OTFF would test the furfural produced and might decide to sell this product at some point in the future.

Acetic and formic acids that remain in the extract act as inhibitors to the n-butanol fermentation. To remove these acids from the extract and increase the amount recovered for sale, the extract would be diluted with condensate from the first concentration step (see Section 2.1.2.2) and evaporated again. The vapor from this stream would be sent to the first concentration step to recycle the organic acids, thereby concentrating them in the extract stream and increasing overall process yield from 80 percent to 94 percent for the organic acids.

2.2.1.7 Desalination/Detoxification

To remove the remaining fermentation inhibitors, a final processing step would remove the remaining salts and acids before fermentation. Membrane electrodialysis would be used to remove these materials. The treated extract would be pumped to the 40,000-gallon storage tanks. The piping from the electrodialysis to the storage tank would be new.

2.2.1.8 Fermentation

From the storage tanks, the treated extract would be mixed with water and nutrient in the makeup tank and then heated to 250 °F to form what would then be called mash. The hot mash would be fed into the first of four maintenance tanks that would provide the required residence time for sterilizing the mash. The hot mash would go to a heat exchanger, and finally through a cooler where it would be cooled to 104 °F. The cooled, sterile mash would then be ready for fermentation.

The sterile mash would be fed to two parallel fermentation trains. Each train would include six seed tanks, two breeding tanks, and six fermentors. Seed would be prepared by adding inoculum into a seed vessel, which would then be filled with approximately 4,000 gallons of mash. The seed would be allowed to grow for 24 hours, and then approximately 70 percent would be transferred to the breeding tank. The seed tank would then be refilled with fresh mash to begin its next 24-hour growth cycle.

The breeding tank, in turn, would be topped off with mash to a volume of approximately 42,000 gallons and allowed to mature for 4 hours. Next, 70 percent of its contents would be transferred, along with fresh mash, to the first fermentor in the six-fermentor train. (The remaining contents would be left in the breeding tank to be used with the next mash addition. Approximately once per month, the tanks would be emptied and cleaned.) Each of the six fermentors would have a capacity of 42,000 gallons. The fermentors would be elevated such that the first fermentor would be higher than the second fermentor, which would be higher than the third fermentor, and so on. This would allow for the cascading of the mash/matured seed mixture from one fermentor to the next using gravity.

Nitrogen would be used to displace oxygen from the mash and through fermentation steps where live cells are active. The organism proposed for use is sensitive to oxygen, so the presence of oxygen in the feed or in the head spaces of the vessels would be detrimental to production. Pressurized nitrogen would be used for the transfer of vessel contents from the seed tanks through the last fermentor. Nitrogen of approximately 99.9 percent purity would be introduced into the vessels starting with the heating tanks and through the beer well.

When the completely fermented mash or beer reached the sixth and last fermentor, it would be pumped to the beer well. Beer from the beer well would be fed continuously to distillation beer towers 1 and 2.

The vapors and gases produced in the fermentation trains would be vented to the vent scrubber for conditioning before exiting to the atmosphere. Chilled pulp mill water would be fed to the top of the packed tower to scrub the gases clean of volatile vapors. The water, which would include recovered n-butanol, acetone, and ethanol, would be sent to the beer well.

2.2.1.9 Distillation

Fermented mash and beer would be fed to the distillation system. A total of seven distillation towers would be needed. The beer feed would be split between two beer towers. The purpose of the beer towers is to remove most of the water and solids. A waste produce that would accumulate in the bottom of the two beer towers would be sent to the wastewater treatment plant.

It is expected that 1.78 million combined gallons per year of n-butanol, acetone, and ethanol would be produced. The approximate breakout of these three products would be 1.36 million gallons of n-butanol, 401,000 gallons of acetone, and 18,000 gallons of ethanol. A small amount of fusel oil would also be produced; this would be sent to the recovery boiler.

2.2.2 Supporting Infrastructure

The proposed biorefinery would require electricity, steam, potable water, domestic wastewater treatment, process water, process cooling water, process wastewater treatment, and exterior storage tanks. Except for the storage tanks, all supporting infrastructure currently exists on the site, as described below.

Electricity: Electricity for the pulp mill is generated from biomass and recovery boilers currently in operation at the site. Due to the addition of the biorefinery, less material would be sent to the recovery boiler because this material would be used in the biorefinery. An additional 2.5 megawatts (MW) of

power would be required to operate the biorefinery. An existing gas turbine (not currently operational) would be utilized to generate 9.5 MW of power. The additional power to the mill, 6.9 MW, would be sold on the open market.

Steam: Steam would be generated from the biomass and recovery boilers currently in operation at the pulp mill. A new heat recovery steam generator (HRSG) associated with the existing gas turbine would supply 45,000 pounds per hour of steam; the balance of the steam necessary for the biorefinery would be made up by the existing boilers. Steam would be primarily used in the acid hydrolysis, concentration, and distillation processes. Steam use would increase by 116,000 pounds per hour. Steam use would be reduced by the recovery of heat equivalent to 17,000 pounds per hour of steam.

Potable Water: OTFF is connected to the City of Old Town municipal water system. Potable water would be used in the biorefinery for employee needs.

Domestic Wastewater: Domestic wastewater from the biorefinery would go to the domestic wastewater system, which discharges to the City of Old Town sanitary sewer. The sanitary sewer discharges to the City of Old Town municipal wastewater treatment plant. Domestic water use and wastewater generated by the 16 new employees is estimated to be approximately 400 gallons per day based on a use rate of 20 gallons per day per employee (State of Maine, Chapter 241, Subsurface Wastewater Disposal Rules, Table 4C, Design Flows for Other Facilities).

Process Water: Process water would be supplied from the pulp mill process water system, which previously fed the former tissue mill. Process water is currently derived from Penobscot River and is treated through coagulation and filtration. The pulp mill currently removes 28 million gallons per day from Penobscot River. Expected consumption of process water would be 965,000 gallons per day plus 13 million gallons per day of cooling water, for a total of 13.9 million gallons per day.

Process Cooling Water: For services requiring a more constant temperature and to reduce overall water consumption, a closed-loop cooling circuit would be utilized. The existing biomass boiler cooling towers would be expanded by another cell (outside the proposed biorefinery building) to increase capacity and account for additional head load from the surface condensers. A total of 104 million British thermal units of cooling capacity would be required.

Process Wastewater: All process wastewater would discharge to the existing OTFF wastewater treatment plant. The pulp mill operates an on-site wastewater treatment plant under Maine Pollutant Discharge Elimination System (MEPDES) Permit No. ME0002020 and No. W002226-5N-H-R). This permit reflects the future operation of the proposed biorefinery.

OTFF currently produces approximately 12 million gallons per day of wastewater that is treated in the pulp mill's existing wastewater treatment facility. The system is permitted to treat 24.4 million gallons per day of treated process waters (including landfill leachate). The proposed project would generate approximately 585,000 gallons of wastewater per day, which would be transported via existing pipes and treated at the existing wastewater treatment facility. The wastewater treatment plant has adequate capacity to treat this wastewater within the limits of the existing permit.

Exterior Storage Tanks: OTFF would require six exterior storage tanks and a 10-by-15-foot pump house associated with a cooling tower cell for the proposed project (see Figure 2-5). Their locations would be on existing, impervious areas of the mill. The tank diameters would vary from 8 feet to 14 feet and range from 13 feet to 18 feet in height. The cooling tower cell would increase the capacity of the

existing biomass boiler cooling towers by allowing cooling water to continuously pass through the cell. The exterior storage tanks would store the following products at the maximum capacities identified:

- N-butanol storage tank with a capacity of 30,000 gallons
- Acetone storage tank with a capacity of 10,000 gallons
- Lime storage silo with a capacity of 1,900 cubic feet
- Nitrogen storage tank with a capacity of 11,000 gallons
- Acetic acid storage tank with a capacity of 39,000 gallons
- Formic acid storage tank with a capacity of 16,000 gallons

2.2.3 Construction

OTFF would obtain all appropriate environmental and building permits (see Table 2-2). Following receipt of the required permits, construction time for the proposed project would be 14 months. Construction of the biorefinery is projected to commence in October 2011, and the biorefinery is expected to be operational in January 2013.

OTFF would have full-time construction management on the site throughout the duration of construction activities. OTFF would designate an area on the site near the former tissue mill for placement of temporary job trailers and storage areas during construction. Subcontracted labor would be used. The biorefinery construction contractor would establish an office on the site where all people and equipment entering the construction work zones would report. Contractor employees would park their vehicles in the pulp mill parking lot. As a safety precaution, only construction equipment and subcontractor and supervisor vehicles would have access to the construction zones. OTFF would assign an on-site manager to monitor installation and safety. At the peak of construction, approximately 80 construction contractor personnel would be needed.

2.2.4 Roads and Facility Access

Most trucks would come from Interstate 95, taking the Stillwater Avenue exit, turning right at Center Street and right onto U.S. Highway 2 (South Main Street), and enter the site using the current access to OTFF property on Portland Street off South Main Street. No additional roads would need to be constructed and no road improvements would necessary for the proposed project. During the construction period, approximately 50 trucks per week and 400 passenger vehicles per week would enter and exit the site.

2.2.5 Major Equipment

Although the pulp mill is on approximately 180 acres, the proposed biorefinery would require 0.9 acre (40,000 square feet) in the 5.7 acre (250,000 square foot) former tissue mill (now vacant). The exterior storage tanks, pump house, and cooling tower cell are expected to require approximately 0.5 acre. Most of the proposed project would be in the former tissue mill. Activities that would not be in the former tissue mill are as follows:

- The extraction vessel would remain at its current location in the pulp mill where the feedstock pretreatment and extraction processes would occur (see Figure 2-3 and Section 2.1.2.1).
- A series of aboveground pipelines would be installed between the pulp mill and the biorefinery to facilitate the movement of products to and from the biorefinery. These would be housed in an existing pipe bridge that currently contains similar sized pipelines (see Figure 2-5)

- Six storage tanks are expected to be installed outside the former tissue mill (see Figure 2-5 and Section 2.1.3).
- An HRSG would be added adjacent to the existing gas-fired turbogenerator. This would be outside and next to the biorefinery building. A pump house and cooling tower cell would be located between existing buildings northeast of the biorefinery building.
- Thirteen towers and columns would extend above the roofline of the biorefinery building. A portion of the roof and exterior wall of the former tissue mill would be removed for the new equipment. Seven towers and columns would be located in the fermentation/distillation area, and six towers would be in the acids recovery area. These towers and columns would range in diameter from 20 inches to 7.5 feet and vary in height from 25 feet to 100 feet extending up to 70 feet beyond the roofline. Five of the six columns located in the acids recovery area would be individually housed in a 12-foot by 14-foot structural steel frame.

No new buildings (except the 10-by-15-foot pump house) would need to be constructed because the biorefinery would be housed in the existing former tissue mill.

Storage tanks would be equipped with secondary containment for potential spills. The containment structures would hold the contents of the largest tanks and have enough additional capacity for precipitation (rain or snow), as required by U.S. Environmental Protection Agency (EPA) regulations at 40 CFR 112.

Few changes would be made to the exterior of the former tissue mill, which would house the biorefinery. Part of the roof would be removed from the building to make room for 13 distillation columns. In addition, the part of the outside wall that supports the roof would be removed.

Because the biorefinery would be integrated into the existing pulp mill, additional pipelines would need to be installed to transport raw materials and products to and from the biorefinery. All pipelines would follow a direct route from the pulp mill to the biorefinery in the existing aboveground pipe bridge at the pulp mill. At present, there are numerous existing aboveground pipelines in the pipe bridge that transport materials throughout the pulp mill. These pipelines would vary in size depending on the required capacity. The largest pipeline would be approximately 6 inches in diameter. The pipelines would be approximately 1,000 feet long. The following pipelines would be needed:

- Extract pipeline to transport the extract from the pulp mill to the biorefinery
- Lignin pipeline to transport 2,526 dry pounds per hour of lignin from the biorefinery to the pulp mill to be burned in the recovery boiler
- Vent gas pipeline to transport non-condensible gases from the concentration process to the boiler for heat recovery
- Waste condensate pipeline to transport 88 gallons per minute from the concentration process to the bleach plant in the pulp mill

Changes to the interior of the building would include:

- Removing existing equipment. Existing equipment would be kept for spare parts or scrapped for salvage value.
- Installing the biorefinery equipment.
- Installing steel framing, along with foundations and piers, for a new 10-foot-wide three-level pipe rack approximately 80 feet long running along the east side of the former tissue mill to the south side where a new distillation structure would be installed. The distillation structure would be

approximately 20 feet by 60 feet, with three levels of platforms at the 20-foot, 40-foot, and 60-foot levels.

- Removing the existing first-floor composite concrete slab for the installation of new tanks. The concrete debris, mixed with rebar, would be transported to the landfill (approximately 1,200 cubic feet).
- Installing two new sewer trenches in the biorefinery building to handle drains from the distillation column drains for both n-butanol production and acid recovery. These drains would be tied into the existing process sewers in the biorefinery building.

2.2.6 Operations

The biorefinery would operate 24 hours per day, 7 days per week, 350 days per year. There would be an annual shutdown of approximately 10 days for facility maintenance, and regularly scheduled shutdowns. Operations would include two 12-hour shifts.

2.2.6.1 Materials Balance

Table 2-1 summarizes the biorefinery inputs, products, and major waste streams. It is not known at this time whether OTFF would utilize road or rail to transport saleable products. Sulfuric acid would be delivered to the site at a rate of nine trucks per week. Lime would be delivered to the site at a rate of three trucks per week. Sodium hydroxide would be delivered to the site at a rate of two trucks per week and there would be one truck of ethyl acetate each month. Gypsum would be transported to a landfill via truck, resulting in an additional two trucks per day. Trucks would enter the site from Interstate 95, taking the Stillwater Avenue exit, turning right at Center Street and right onto South Main Street, and enter the site using the current access to OTFF property on Portland Street off South Main Street. Pan Am Railways owns and operates a rail line that runs adjacent to the pulp mill. At present, the pulp mill receives approximately 555 trucks, 910 passenger vehicles, and 42 rail cars per week.

2.2.6.2 Materials Handling

OTFF would handle the materials described below on the site as part of the proposed biorefinery project.

Sulfuric acid: Sulfuric acid (93 percent) would be used in the acid hydrolysis step to remove lignin from the extract. Sulfuric acid usage is anticipated to be approximately 3.6 gallons per minute. The sulfuric acid storage tank is proposed to be located in the biorefinery and would include concrete secondary containment.

Sodium hydroxide: Sodium hydroxide (50 percent), also known as caustic soda, is a key component that would be used to raise pH levels of extract before concentration. Sodium hydroxide is currently used at the pulp mill for a variety of purposes, and would be used in the biorefinery during the extraction stage. It is expected that 0.46 gallons per minute would be used in this process.

Calcium hydroxide: OTFF would transport lime in bulk, store it in a new silo with a pollution control device for dust control, and mix it with water to form a calcium hydroxide solution. The solution would be used to neutralize the sugar stream after acid hydrolysis. Calcium hydroxide at the rate of 8.0 short tons per day (dry basis) would be added to the hydrolyzed extract to raise the pH from 1 to 2.5.

Table 2-1. Materials Balance

Material Description	Amount
Biorefinery inputs	
Feedstock (existing on the site)	1,200 metric tons per day (dry basis)
Sulfuric acid (93 percent sulfuric acid)	3.6 gallons per minute
Lime (Calcium hydroxide)	8.0 Short tons per day (dry basis)
Sodium hydroxide (50 percent sodium hydroxide)	0.46 gallons per minute
Ethyl acetate	19 pounds per day
Process water	670 gallons per minute
Cooling water	9,000 gallons per minute
Biorefinery products	
N-butanol	1.36 million gallons per year
Acetic acid	2.29 million gallons per year
Formic acid	815,000 gallons per year
Acetone	401,000 gallons per year
Biorefinery by-products and waste	
Gypsum	33.8 dry short tons per day
Ethanol	18,000 gallons per year
Wastewater	585,000 gallons per day
Wastewater sludge	20 dry tons per day
Lignin	2,526 dry pounds per hour
Salt	3,275 dry pounds per hour
Non-condensible gas	1,000 pounds per hour
Furfural	106,000 gallons per year

Nitrogen: Nitrogen would be supplied from commercially available leased equipment from a local vendor. This supply would be needed at a steady-state rate of approximately 670 pounds per hour. This would amount to a weekly consumption of 123,000 pounds. Nitrogen would be vented via the fermentation vent system via a scrubber to the atmosphere.

Spent Material Handling:

The precipitated lignin would be sent via aboveground pipeline to the recovery boiler in the pulp mill and burned to recover the heat value. Lignin would be produced at a rate of 2,526 dry pounds per hour.

- The recovered gypsum separated after acid hydrolysis would be sent to a landfill. Gypsum would be produced in the biorefinery at a rate of 33.8 dry short tons per day.
- Fermentation gases would be collected and sent to catalytic oxidizers. The remaining high-volume gases would be collected and combined with those currently being sent to the lime kiln or biomass boiler. High-concentration gases would be collected and sent to the existing non-condensable gas systems. Non-condensable gas would be produced at a rate of 1,000 pounds per hour.
- The biorefinery would convert approximately 80 percent of the biochemical oxygen demand (BOD) to n-butanol and acid products, resulting in approximately 585,000 gallons per day of wastewater that would include distillate bottoms and evaporator condensate, which would be sent to the wastewater treatment plant. At present, two additional aerators have been estimated to account for the approximate BOD loads to the wastewater treatment facility. The facility now runs at much lower loadings than the original design, both hydraulically and from a BOD perspective.
- Ethanol would be produced during the fermentation process at a rate of 18,000 gallons per year. Once produced, the ethanol would be stored in the 1,300-gallon product ethanol check tank. The ethanol product would contain a small amount of n-butanol, a trace amount of acetone, and

approximately 15 percent water. The ethanol product would be sent to the boiler to be burned to recover the heat value.

- Furfural would be produced during the acid recovery stage. At this time, OTFF would send the 106,000 gallons produced per year to the boiler to be burned to recover the heat value. Furfural is a saleable product in sufficient quantities and at a sufficient quality; OTFF might choose to sell this product once the biorefinery is operational, depending on product quality.

Acetone: Acetone would be produced during the fermentation process at a rate of 401,000 gallons per year. Once produced, the acetone would be stored in the 2,500-gallon product acetone check tank. Once product testing was completed, the acetone would be transferred to the exterior 10,000-gallon product storage tank and then loaded for transport to off-site customers.

N-butanol: N-butanol from the distillation area would go to the 4,800-gallon product n-butanol check tank for holding until product testing was complete. Once product testing was complete, n-butanol would be transferred to the exterior 30,000-gallon product storage tank and loaded for transport to off-site customers. The biorefinery would produce 1.36 million gallons per year of n-butanol.

Acetic acid: Acetic acid from the acids recovery area would go to a tank for holding until product testing was complete. Once product testing is complete, the acetic acid would be loaded for transport to off-site customers. The biorefinery would produce 2.29 million gallons per year of acetic acid.

Formic acid: Formic acid from the acids recovery area would go to a tank for holding until product testing was complete. Once product testing is complete, the formic acid would be loaded for transport to off-site customers. The biorefinery would produce 815,000 gallons of formic acid per year.

2.2.6.3 Startup, Shutdown, Maintenance, and Emergency Processes

OTFF anticipates that the biorefinery would operate for a minimum of 10 years and would normally operate 24 hours per day, 7 days per week. The facility would operate approximately 350 days per year. OTFF would schedule minor maintenance activities regularly throughout the operating year. There would be an annual shutdown of approximately 10 days for facility maintenance and a total of 5 days for regularly scheduled shutdowns. This would limit the number of times the facility would go through a complete startup and shutdown cycle.

OTFF would develop standard operating procedures for each operating system and the associated pollution control systems, as follows:

- Feedstock pretreatment
- Concentration
- Acid hydrolysis
- Lignin separation
- Neutralization, gypsum separation
- Acids recovery
- Desalinization and storage
- Fermentation and distillation
- Gas turbine/HRSG operation

The proposed project would shut down under emergency conditions such as loss of power or process water. The project would use existing emergency services from the City of Old Town in the event of a fire. The pollution control systems would be interconnected with motor controls on the process

equipment. Shutdown of the pollution control device would automatically shut down the associated process.

2.2.6.4 Operations Workforce

During operations, the biorefinery project would require a permanent workforce of approximately 16, which the surrounding area's population and skilled personnel could support. OTFF expects to hire the necessary people from existing local and regional resources. Biorefinery employees would park in existing parking areas at the pulp mill.

2.2.6.5 Feedstock Availability

The biorefinery would not increase woodchip demand or require any new equipment at OTFF.

2.2.7 Permits, Approvals, and Applicant-Committed Measures

The proposed project would require a number of environmental permits, approvals, and plans for construction and operation, as summarized in Table 2-2.

Table 2-2. Potentially Applicable Permits, Approvals, and OTFF-Committed Measures

Activity	Permit, Plan or Approval	Parties Involved	Completed by	Status
Federal				
Production and sale of fuel butanol	Alcohol fuel producer permit	U.S. Environmental Protection Agency	Operations	OTFF would submit TTB Form 5110.74 to the Department of the Treasury.
Transportation, handling, and sale of hazardous materials	Transportation and handling of hazardous materials Certificate of Registration	U.S. Department of Transportation	Operations	OTFF would register online prior to operations. OTFF would collect information, maintain records, and submit reports as required by the U.S. Department of Transportation.
Endangered Species Act compliance	Informal Section 7 Consultation	U.S. Fish and Wildlife Service and National Marine Fisheries Service	Operations	Informal consultation ongoing with agencies. In letters sent on May 11, 2011, DOE asked for concurrence that the proposed project *is not likely to adversely affect* listed species. Letters of concurrence were received from U.S. Fish and Wildlife Service and National Marine Fisheries Service on July 21, 2011 and June 30, 2011 respectively.
State				
National Historic Preservation Act compliance	Section 106 approval	Maine Historic Preservation Commission	Construction	Letter sent to the Maine Historic Preservation Commission on June 10, 2011. Letter of concurrence received from the Maine Historic Preservation Commission on June 17, 2011.

Table 2-2. Potentially Applicable Permits, Approvals, and OTFF-Committed Measures (continued)

Activity	Permit, Plan or Approval	Parties Involved	Completed by	Status
State (continued)				
Pollutant Discharge	Maine Pollutant Discharge Elimination System No. ME0002020	Maine Department of Environmental Protection (MEDEP)	Operations	On May 19, 2011, a Final Wastewater Discharge License was issued for the pulp mill (Maine Waste Discharge License No. W002226-5N-H-R). The new license reflects the future operation of the proposed biorefinery.
Stormwater	Stormwater Pollution Prevention Plan	MEDEP	Operations	A new Maine Multi Sector General Permit went into effect on April 26, 2011. The Stormwater Pollution Prevention Plan was updated under the new Multi Sector Permit on May 25, 2011
Air Emissions	Title V Air Permit No. A-180-70-AI	MEDEP	Operations	An application for a Minor Permit Modification was submitted to MEDEP in June for the proposed biorefinery. An application for a Major Permit Modification will be submitted to MEDEP in August for the gas turbine, which has not operated for several years.
Local				
Zoning	Plan Review under the City of Old Town Zoning Ordinance	City of Old Town	Construction and operations	Application submitted in June 2011.
Building	City of Old Town Building Permit	City of Old Town	Construction	Once the Amendment to Existing Site Location Development Permit is obtained, OTFF would apply for the City of Old Town Building Permit.

2.2.8 Project Design Features to Minimize the Threat of Intentionally Destructive Acts

The project design would include measures to minimize potential threats or damage from intentionally destructive acts (that is, acts of sabotage or terrorism). The facility design would include additional security lighting and communications procedures with the local 911 emergency response system. In addition, OTFF would staff the facility 24 hours per day.

2.3 No-Action Alternative

CEQ regulations at 40 CFR 1502.14(d) and DOE NEPA implementing regulations at 10 CFR 1021.321(c) require an evaluation of a No-Action Alternative. Under the No-Action Alternative, DOE would not authorize expenditure of federal funds for the proposed project and OTFF would not design, construct, or start-up the OTFF proposed demonstration-scale integrated biorefinery project. Although

this project could proceed if DOE decided not to provide financial assistance, DOE has assumed, for purposes of comparison in this EA, that the project would not proceed without DOE assistance. If the project proceeded without DOE assistance, the potential impacts would be essentially identical to those under the DOE Proposed Action (that is, providing assistance that enables the project to proceed).

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

In this chapter, DOE assesses the following resource areas: land use; water resources; biological resources; air quality; aesthetics; safety and occupational health; waste management and hazardous materials; utilities; traffic; and socioeconomics and environmental justice. Each of the resource sections first describes the affected environment for the subject resource area, and then assesses potential impacts under the Proposed Action and the No-Action Alternative. Section 1.5 discusses environmental resource areas that DOE did not consider in this EA.

3.1 Land Use

This section describes existing land use conditions on and surrounding the site of the proposed project, and the potential for the Proposed Action and No-Action Alternative to impact these existing conditions.

3.1.1 Affected Environment

At present, OTFF operates a pulp mill located on a bend on the western side of Penobscot River (see Figure 2-2). The site is approximately 180 acres that extends from the chip storage and conveying facility at the northern end of the project site to the former tissue converting and tissue warehouse facilities at the southern end of the project site. The property is bounded to the east by Penobscot River and to the west by U.S. Highway 2 (South Main Street). Existing operations on this property include wood chip storage and handling, pulping, bleaching, drying, maintenance, warehousing, fuel storage, and black-liquor storage. Pulp has been produced at this site for more than 100 years. The OTFF wastewater treatment plant is directly west of the pulp mill across South Main Street along Penny Road on approximately 23 acres of OTFF-owned land. The treatment system consists of an aeration pond, spill pond, four clarifiers, and a control building.

The property is located in the City of Old Town Industrial (I-1) Zone, although a portion of the property along the Penobscot River is in the city's Shoreland Zoning Overlay (Industrial-Shoreland [I-1S]). Adjacent properties are primarily zoned residential, and homes are primarily located along South Main Street. The nearest residence is on South Main Street, more than 300 feet from the proposed biorefinery. Forest Hills Cemetery is to the northwest, also along South Main Street. Across the river to the east of the site there are residences along Main Street in Bradley. The City of Old Town's developed area is chiefly located on a relatively large island (Marsh Island) of Penobscot River, although boundaries extend beyond that on both sides of the river. Marsh Island is surrounded by Penobscot River to the east and Stillwater River to the west. French Island is approximately 1 mile to the north of the pulp mill and is a densely populated residential area in Old Town. Downtown Old Town consists of various commercial businesses south of the South Main Street Bridge and a public park north of South Main Street. Riverfront Park is a relatively new public waterfront park area, the primary component of the redevelopment of the 4.5-acre abandoned Lily Tulip factory site.

The immediate project area contains industrial infrastructure used in previous mill operations and includes a main office, pulp mill, pulp warehouse, pulp dryer, lime kiln, beach plant maintenance workshop, cooling tower, biomass burner, pump house, turbine, pipelines, and the former tissue mill.

3.1.2 Environmental Consequences of the Proposed Action

The proposed project would be on an active industrial site adjacent to industrial and residential properties. Although the existing pulp mill is on approximately 180 acres, the proposed biorefinery would only

require 0.9 acre in the 5.7-acre former tissue mill. Six material storage tanks would be constructed on the east side of the former tissue mill. They would be constructed on existing, impervious areas of the mill and would vary in diameter from 8 to 14 feet and range in height from 13 to 18 feet. As part of the proposed project, any site-related construction would take place within the current property boundaries and not be close to any of the property boundary lines.

The proposed project is currently undergoing site plan review under the City of Old Town Zoning Ordinance. When the review is complete, OTFF expects the city would approve the site plan. OTFF submitted the application on June 10, 2011. The first Planning Board meeting and public hearing will be held on July 12, 2011. If the city approves the site plan, the OTFF would have to obtain a building permit to construct the facility.

While the project would alter approximately 0.5 acre of existing impervious areas of the pulp mill, and the former tissue mill would be repurposed, there would be a very small impact on land use because the intended industrial use of the property would not change. Therefore, biorefinery construction and operations would not change or affect current adjacent land uses.

3.1.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding to OTFF, and OTFF would not build the biorefinery. There would be no changes in land use under this alternative.

3.2 Water Resources

This section describes water resources, including groundwater, surface water, and floodplains, on and surrounding the site of the proposed project, and the potential for impacts to these resources as a result of the Proposed Action and No-Action Alternative.

3.2.1 Affected Environment

3.2.1.1 Groundwater

According to U.S. Geological Survey, Old Town, Maine, 7.5-minute series topographic map, the elevation of the pulp mill is approximately 90 to 150 feet above mean sea level. Regional topography in the area slopes downward toward Penobscot River. Based on surface topography, and assuming that groundwater piezometric surface mimics the surface topography, groundwater flow beneath the pulp mill is expected to flow in a generally easterly direction, toward the Penobscot River (MEDEP 2006).

The existing pulp mill does not use groundwater, and there are no existing EPA-designated sole source aquifers (an underground water source that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer; EPA 2011b) at the pulp mill site. The only EPA-designated sole source aquifers are on islands off the coast of Maine. In addition, there are no mapped significant sand and gravel aquifers on or near the project site, as mapped by the Maine Geological Survey (MEDEP 2006).

3.2.1.2 Surface Water

The Penobscot River borders the project property to the east; see Figure 2-1. The Penobscot River is New England's second largest river system, and has a drainage basin area of approximately 8,750 square miles, a maximum length (from north to south) of approximately 125 miles. This river is not categorized as a wild and scenic river.

The Penobscot River waters in the vicinity of the pulp mill are Class B, which means they are of sufficient quality for a drinking water supply (following treatment), fishing, and contact recreation, and as unimpaired habitat for fish and other aquatic life (FERC 2010).

At present, the pulp mill draws approximately 28 million gallons per day of process water from Penobscot River, and treats it through an existing coagulation and filtration system.

3.2.1.3 Floodplains

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, the property site along the Penobscot River is in Zone B, which indicates an area of moderate flood hazard, usually the areas between the limits of 100-year and 500-year floods (see Figure 3-1). Areas designated as Zone B are also floodplains of lesser hazard, such as those with levees that protect against the 100-year flood, or are shallow flooding areas with average depths of less than 1 foot or drainage areas less than 1 mile. The existing pulp mill total services pump house, the lower portion of sandfilter building, lower portions of the recovery boiler utilities building, parts of the dam/powerhouse structure, a corner of the north woodroom, and part of the biomass storage building are in the 100-year floodplain.

3.2.1.4 Wastewater

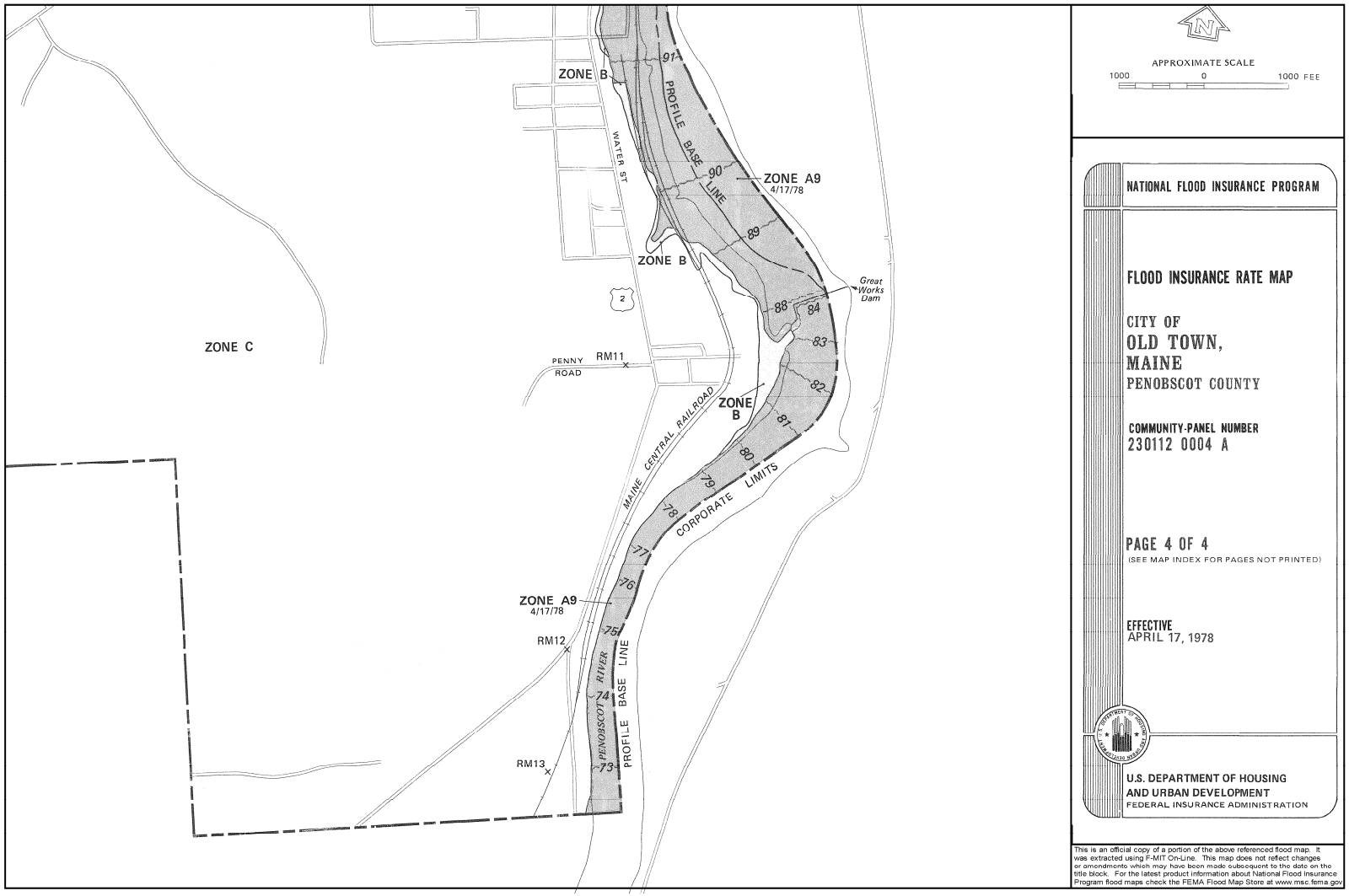
OTFF domestic wastewater is discharged to the City of Old Town sanitary sewer system, which discharges to the city's wastewater treatment plant.

The federal National Pollutant Discharge Elimination System program was delegated to the State of Maine on January 12, 2001. Subsequently, the State of Maine developed its MEPDES program. The pulp mill operates an onsite wastewater treatment plant under MEPDES Permit No. ME0002020. The permit expired on August 6, 2007, and OTFF continued to operate under this permit, which the regulations allow when a suitable application has been filed with the State of Maine. OTFF submitted such an application on July 26, 2007, and the MEDEP accepted the application on that date. On February 22, 2011, OTFF submitted an amendment to their pending wastewater discharge application to reflect the loadings from the proposed biorefinery. On March 8, 2011, the MEDEP issued a Preliminary Draft Permit for the pulp mill that included the wastewater loadings from the proposed biorefinery. On May 19, 2011, a Final Wastewater Discharge License (No. W002226-5N-H-R) was issued for the pulp mill (see Appendix C).

The OTFF wastewater treatment plant occupies approximately 23 acres along Penny Road and consists of a bar screen, two primary clarifiers, an aerated lagoon with nutrient addition for secondary treatment, and two secondary clarifiers. OTFF adds polymer to the primary and secondary sludge and then dewaters the sludge in a screw press. A belt press is available if the screw press is down for maintenance. The sludge is disposed of in a State of Maine licensed special waste landfill.

The pulp mill currently produces approximately 12 million gallons per day of wastewater that is treated in the mill's existing wastewater treatment facility. The system is permitted to treat 24.4 million gallons per day of treated process waters (including landfill leachate). OTFF is authorized to discharge from four outfalls in accordance with their MEPDES permit. Secondary treated process wastewater is discharged from Outfall No. 001. The bleach plant effluent (internal waste stream) is an internal waste discharged from Outfall No. 100 that ultimately goes to the wastewater treatment system. Non-contact cooling waters are discharged to Penobscot Rive from Outfall No. 002, and filter backwash is discharged from Outfall No. 003 to Penobscot River.

Figure 3-1. Federal Emergency Management Agency Flood Insurance Rate Map



3.2.1.5 Stormwater

The pulp mill is operating under the Multi-Sector General Permit for Stormwater[1] and a Storm Water Pollution Prevention Plan (SWPPP) is in place. The Multi-Sector General Permit provides stormwater standards for industrial activities including requirements for preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan. The EPA has developed regulations for stormwater discharges associated with many industrial activities. As part of the MEPDES permitting process, industrial operators are required to manage and monitor their stormwater runoff. The SWPPP and the SPCC Plan for OTFF were developed to assist in complying with the requirements of the Multi-Sector General Permit for Stormwater Discharges associated with industrial activity and MEPDES requirements.

3.2.1.6 Wetlands

As a result of site investigations for a U. S. Army Corps of Engineers permit for a separate project (Milone & MacBroom, Inc. 2010), the only jurisdictional wetland or water identified in the project area is the Penobscot River channel. The boundaries of inland wetlands and watercourses on the site were delineated in accordance with the 1987 *Corps of Engineers Wetland Delineation Manual,* as modified by technical guidance from the Corps of Engineers. Federal wetlands under Corps of Engineers jurisdiction were delineated using the three-parameter approach (hydric soils, hydrophytic vegetation, and hydrologic support) documented by submittal of perpendicular transect forms. The site investigation of April 28, 2010, revealed that there are no wetlands close to the pulp mill site apart from the river itself (Milone & MacBroom, Inc. 2010). In addition, the National Wetland Inventory Maps shown in Figure 3-2 did not indicate the presence of wetlands within the boundaries of the project site.

3.2.2 Environmental Consequences of the Proposed Action

3.2.2.1 Groundwater

The proposed project would not use groundwater resources as a source of potable or process water. Therefore, there would be no impacts to groundwater.

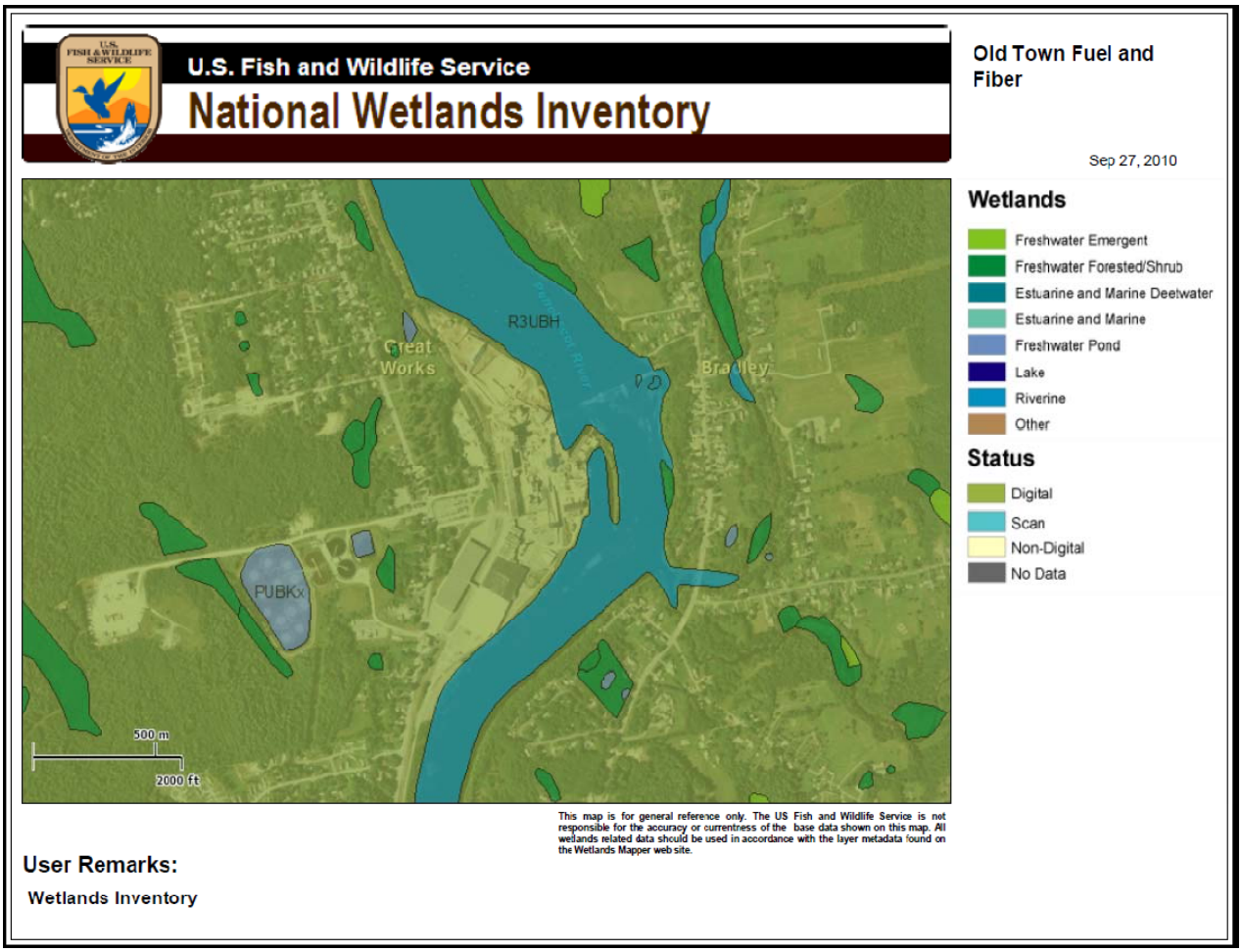
Several measures for preventing soil and groundwater contamination would be developed. These measures would include the development of both a construction SWPPP and an operations SWPPP, as well as an SPCC Plan, as required by the MEPDES and the Maine Multi-Sector General Permit for Stormwater. The proposed project would use facility designs that include secondary containment and have operations policies and procedures to manage and store such materials, so there should be no releases. In the unlikely event of an accidental release, the facility would follow the updated SPCC Plan to contain, manage, and clean up the release. These procedures would minimize, to the extent practicable, potential impacts to any surficial aquifer.

3.2.2.2 Surface Water

Process water would be supplied from the existing OTFF process water system. This system previously fed the former tissue mill where the biorefinery would be housed. Expected consumption of process water for the biorefinery facility is 965,000 gallons per day and 13 million gallons per day of cooling water, for a total of 13.9 million gallons per day.

[1] Renewal of the Maine Multi-Sector General Permit for Stormwater Discharge Associated with Industrial Activity was signed and in effect on April 26, 2011 (MEDEP 2011a).

Figure 3-2. Wetland Inventory



3.2.2.3 Floodplains

The proposed project would be outside the 100-year floodplain. Therefore, there would be no impacts related to locating a structure within the 100-year floodplain.

3.2.2.4 Wastewater

The proposed project would continue the use of the municipal wastewater treatment facility for all sanitary sewer discharges. No impacts to the municipal wastewater treatment facility would be anticipated from the addition of 16 workers to operate the proposed biorefinery.

The existing OTFF wastewater treatment system has a licensed capacity of 24.4 million gallons per day. Based on pulp mill operating data for 2010, the treatment system is currently processing approximately 12 to 13 million gallons per day. The proposed project would generate approximately 585,000 gallons of wastewater per day, which would be transported via existing pipes and treated at the existing wastewater treatment plant. The wastewater treatment plant has adequate capacity to treat this wastewater within the limits of the existing permit. Table 3-1 lists wastewater volumes and characteristics the biorefinery project would generate.

Table 3-1. Old Town Fuel and Fiber Biorefinery Wastewater Summary

Waste Streams to Wastewater Treatment Plant	Evaporator Foul Condensate	From Acids Recovery	From Butanol Fermentation	Total Wastewater Flow
Total flow (gallons per day)	125,280	126,720	332,640	584,640
Acids[a] (pounds per day)	202	1,298	16,608	
Acetone (pounds per day)	0	0	7	
Butanol (pounds per day)	0	0	24	
Cell mass (pounds per day)	0	0	24,480	
Carbon dioxide (pounds per day)	0	0	0	
Dissolved sugars (pounds per day)	0	0	10,272	
Dissolved solids (inorganic) (pounds per day)	0	0	49,848	
Ethanol (pounds per day)	0	0	1	
Ethyl acetate (pounds per day)	0	9,600	0	
Water (pounds per day)	0	984,281	2,762,160	
Water (gallons per day)		118,019	331,194	
Totals (pounds per day)	202	995,179	2,863,400	
BOD5 (pounds per day)	202	506	9,534	BOD 10,243
Temperature (degrees Fahrenheit)	120	213	94	

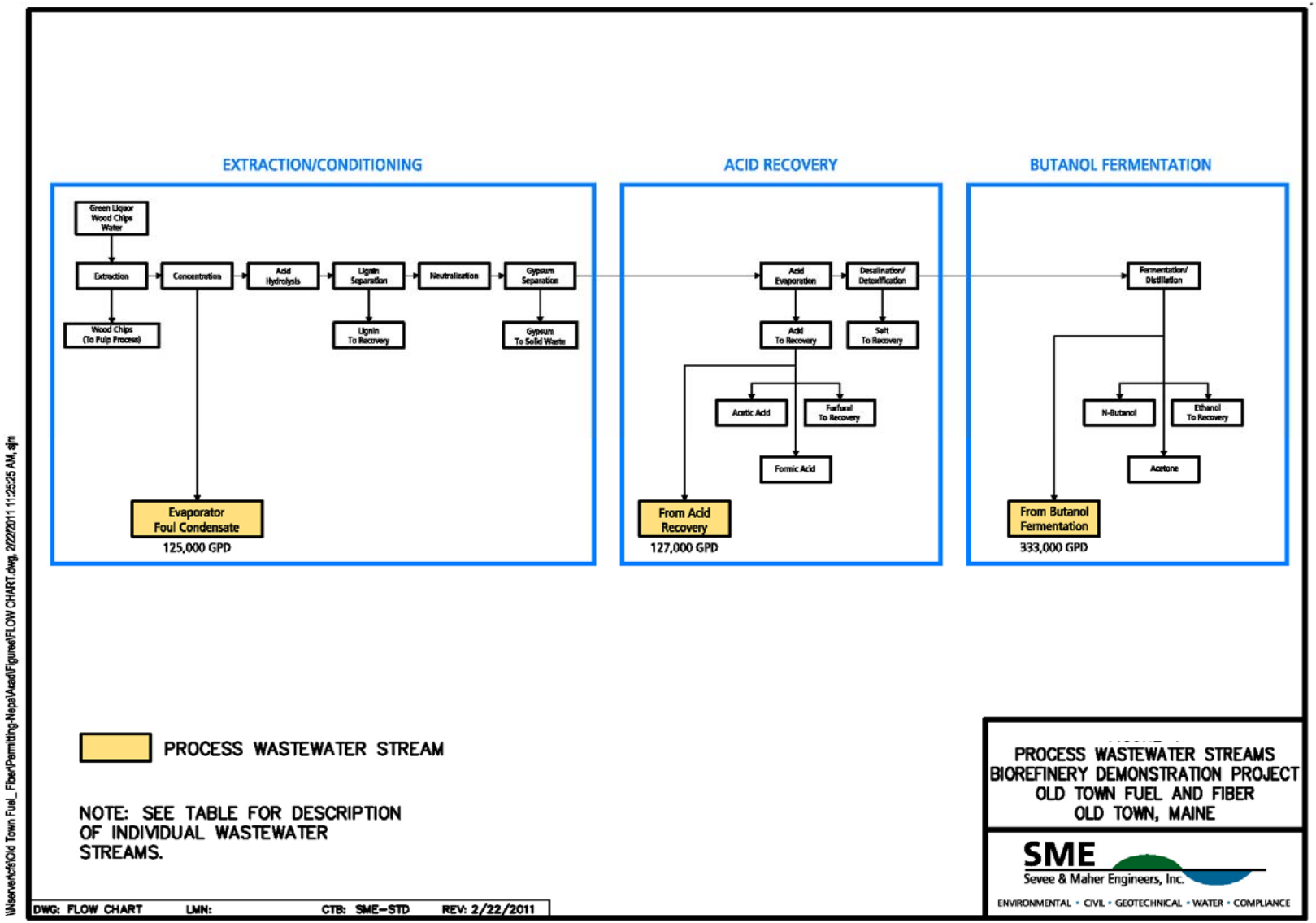
a. The following intermittent flows will be sent to the wastewater treatment system: spent cleaning fluids, hydrolyzer drains, product storage tank/off spec. These flows will represent less than 10,000 gallons per day.
b. BOD = biochemical oxygen demand.

The continuous wastewater discharges (described below) from the biorefinery would come from three unit processes, as shown in Figure 3-3 – extraction/conditioning, acids recovery, and butanol fermentation.

The total wastewater flow from the biorefinery would be approximately 585,000 gallons per day (410 gallons per minute). This flow is divided as follows: extraction/conditioning, which is primarily foul evaporator condensate, 125,000 gallons per day; acids recovery, 127,000 gallons per day; and butanol fermentation, 333,000 gallons per day.

- Small quantities of water used for system cleaning would be discharged intermittently. These flows would represent less than 10,000 gallons per day and would not represent a significant loading to the 24-million-gallon wastewater treatment system.
- The foul evaporator condensate wastewater would have characteristics similar to the wastewater discharged from similar sources at the pulp mill. The biorefinery foul condensate would be blended with the foul condensate from the pulp mill and sent to the wastewater treatment system in the existing foul condensate line.
- In the biorefinery, salts would be recovered from the process and removed from the wastewater stream. Therefore, only trace levels of calcium and sodium salts would be present in the wastewater from the biorefinery.

Figure 3-3. Process Wastewater Streams



- The total BOD loading from the biorefinery is estimated to be approximately 10,259 pounds per day, as follows: foul evaporator condensate, 202 pounds BOD per day; acids recovery, 507 pounds BOD per day; and butanol fermentation, 9,550 pounds BOD per day.
- The seasonal monthly average mass limitation of 102 pounds per day for total phosphorus.

No heavy metals would be added to the biorefinery process; therefore, no heavy metals (other than naturally occurring trace levels) are anticipated to contribute to the waste stream from biorefinery operations. Nutrient loading in the wastewater from biorefinery operations would be minimal. MEPDES Permit No. ME0002020 includes a phosphorous limit of 0.5 milligrams per liter.

On May 19, 2011, the MEDEP issued a new Wastewater Discharge License for the pulp mill, which includes anticipated flows from the proposed biorefinery. In their permit, the MEDEP determined that the addition of the biorefinery to the operation of the pulp mill would not result in impacts to water quality or violations of water regulations, and authorized OTFF to utilize the existing wastewater treatment facility for the proposed project. A copy of the permit is provided in Appendix C. Based on the foregoing, there would be no impacts to water quality as result of the proposed project.

3.2.2.5 Stormwater

No new developed areas or impervious surfaces are proposed as part of the project. Because the storage tank locations are already developed, and contain extensive impervious surface area, no significant changes to existing site grading would occur that would alter surface-water drainage patterns on the site. With no increase in developed or impervious areas and no changes in drainage patterns, there would be no impacts to surface water resulting from construction or operation of the proposed project.

Impacts to surface-water quality could occur from accidental releases of hazardous materials from facility operations. The proposed project would use facility designs that include secondary containment of outside tanks and chemical loading areas and have operations policies and procedures to manage and store such materials; therefore, releases should not occur. Before construction of the proposed project begins, the SWPPP would be updated to include the outside tanks; minimal other changes are expected. The SPCC Plan would also be updated to include the biorefinery in accordance with applicable regulations. If an accidental release occurred, the SPCC Plan would be followed to contain, manage, and clean up the release. These procedures should minimize, to the extent practicable, potential impacts to surface-water quality.

3.2.2.6 Wetlands

There are no wetlands in the proposed project area and there be no impacts to wetlands as a result of the proposed project.

3.2.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding to OTFF, OTFF would not construct the proposed biorefinery, and the pulp mill would continue to operate under its existing MEPDES permit. The MEDEP has determined that the pulp mill effluent does not impair water quality in Penobscot River.

3.3 Biological Resources

This section describes the biological resources in terms of upland and aquatic habitats and special status species, and the impacts to these species and their habitats as a result of the Proposed Action and No-Action Alternative.

3.3.1 Affected Environment

3.3.1.1 Upland Areas and Vegetation

Upland areas on the approximately 180-acre project site have been developed for many years. Areas that do not have structures are generally characterized by asphalt for roadways or pads, or disturbed dirt with little to no vegetation. Adjacent to the Penobscot River in the southern portion of the project site there are some areas of native and nonnative grasses where riparian-associated trees are also present. Generally, the project site does not have upland habitat suitable for wildlife, although some bird and mammal species could be present in the area, especially along the river bank.

In 2010, as part of the Penobscot Trust dam removal project, the Federal Energy Regulatory Commission (FERC) released the Final EA for Application for Surrender of License, Veazie, Great Works, and Howland Projects, FERC Project Nos. 2403-056, 2312-019, and 2721-020 (hereinafter the Dam Removal EA) (FERC 2010). This dam removal project includes the removal of two dams: Great Works Dam, which is adjacent to the proposed project site, and Veazie Dam, which is approximately 7 miles downstream of the pulp mill.

As part of dam removal preparation, extensive biological analyses and surveys were performed in and around Great Works Dam. Biological surveys of the western bank (the location of the pulp mill site) near the Great Works impoundment were performed by Santec in 2008. These surveys identified mainly common grasses, weeds, and typical landscape species (FERC 2010). Species observed include Kentucky bluegrass (*Poa pratensis),* ragweed (*Ambrosia artemisiifolia*), common St. Johnswort (*Hypericum perfoliatum*), Queen Anne's lace (*Daucus carota*), meadowsweet (*Filipendula ulmaria*), staghorn sumac (*Rhus typhina*), gray birch (*Betula populifolia*), and pin cherry (*Prunus pennsylvanica*). Upland habitats on the eastern shore of the Penobscot River offer more diversity and provide more suitable habitat for upland-associated species. The dominant community was identified as alder shrub thicket, which consists of dense shrub cover on the river shoreline, and belongs to the palustrine scrub-shrub wetland class (Cowardin et al. 1979 as reported in FERC 2010). Typical shrubs consist of speckled alder (*Alnus incana*), northern arrowwood (*Viburnum recognitum*), box elder (*Acer negundo*), white birch (*Betula papyrifera*), steeple-bush (*Spiraea tomentosa*), and meadow sweet. In some areas honeysuckle (genus *Lonicera*) comprises portions of the understory. Virgin's bower (*Clematis virginiana*) was also found in several locations. Dominant herbs (although somewhat limited) within the community include sensitive fern (*Onoclea sensibilis*), bluejoint (*Calamagrostis canadensis*), timothy (*Phleum pratense*), tall meadow-rue (*Thalictrum pubescens*), and royal fern (*Osmunda regalis*) (FERC 2010).

Although there is very limited vegetation along the west river bank adjacent to the pulp mill property, more dense vegetation is present up- and downstream of the pulp mill and on the eastern bank. In these areas, there is presence of heavy tree cover. Dominant forested wetland communities within the Great Works impoundment were classified as Silver Maple Floodplain Forests (FERC 2010). Silver maple (*Acer saccharinum*) was the dominate species, accounting for approximately 70 percent of the canopy. Additional subdominant trees present include green ash (*Fraxinus pennsylvanica*) and red maple (*Acer rubrum*). The shrub layer was not well developed, but includes species such as meadowsweet, green ash, and red maple.

Upland bird species with potential to occur in the vicinity of the proposed project include the downy woodpecker (*Picoides pubescens*), black-capped chickadee (*Poecile atricapillus*), and the American goldfinch (*Carduelis tristas*). Additionally, woodland rodents such as the eastern chipmunk (*Tamias striatus*), gray squirrel *(Sciurus cardimensus*), and snowshoe hare (*Lepus americanus*) are expected in the forested and shrub area of the project. Larger mammals, including white tailed deer (*Odocoilus virginianus)* and moose (*Alces alces*) might also be present in the vicinity of the Penobscot River (FERC 2010).

3.3.1.2 Aquatic Habitats

OTFF owns and operates an existing wastewater treatment plant on the site. The wastewater treatment plant discharges its effluent to the Penobscot River under MEPDES Permit No. ME0002020 (see Appendix C), which specifies allowed effluent discharge rates and characteristics to safeguard water quality in the Penobscot River and to protect aquatic life. OTFF is authorized to discharge from four outfalls in accordance with their current MEPDES permit (see Figure 3-4). Secondary treated process wastewaters are discharged into the Penobscot River via Outfall No. 001. Bleach plant effluent (an internal waste stream) is discharged from Outfall No. 100 and routed to the wastewater treatment system. Non-contact cooling waters are discharged to the Penobscot River from Outfall No. 002, which is not currently used. Filter backwash is discharged to the Penobscot River from Outfall No. 003 (see Figure 3-4). The permit specifies limits to the discharge rates and characteristics of the effluent for each outfall that discharges to the Penobscot River, including:

- Seasonal daily maximum and monthly average mass limits for BOD and total suspended solids from the outfalls
- Daily maximum temperature, thermal loading, and pH range limits for the outfalls
- Limits for chemical contaminants, including metals and organic pollutants (e.g., dioxins and furans)
- Requirements for whole effluent toxicity (WET) and chemical specific (priority pollutant) testing for Outfall No. 001.

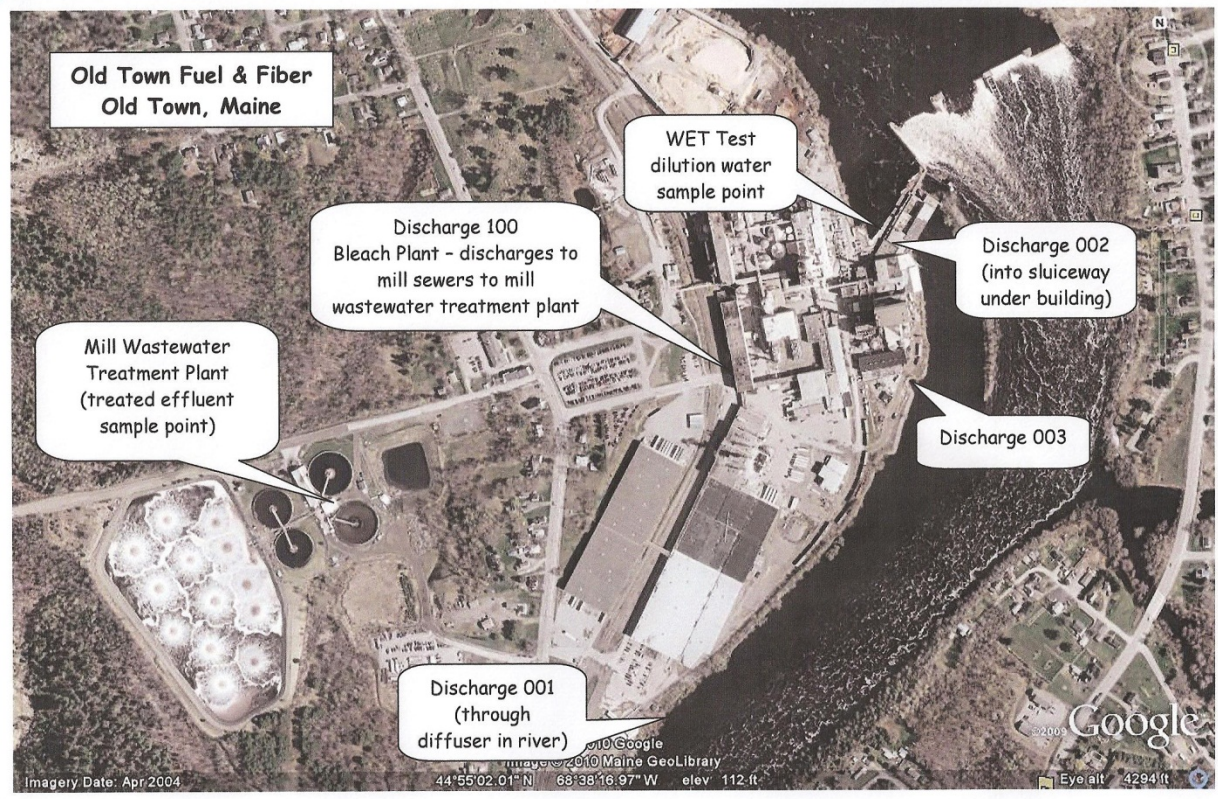
A MEDEP 2007 survey indicated adequate dissolved oxygen for salmon, and that under baseline conditions, the pulp mill effluent does not impair the functioning of the Penobscot River for adult Atlantic salmon migration or other fisheries.

Great Works and Veazie dams are slated for removal to provide upstream passage to fish as part of a public and private effort led by the Penobscot Trust. Once the two dams are removed, the federally listed endangered Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon (*Salmo salar*), and the endangered shortnose sturgeon (*Acipenser brevirostrum*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) (a candidate species for listing), will have access to portions of the Penobscot River upstream of the dam locations, including the reach of the river adjacent to the pulp mill and its wastewater treatment effluent discharge pipe. Section 3.3.1.3 provides a complete discussion of special status fish.

3.3.1.2.1 Reptiles and Amphibians

As part of the Great Works Dam removal project, it will be necessary to move the OTFF water supply intake downstream from its current location behind the impoundment. In 2010, the Penobscot Trust applied to the Corps of Engineers for a permit to move the water supply intake. A site investigation in April 2010 as part of the proposed move of the water supply intake found that there are no wetlands close to the pulp mill site apart from the Penobscot River itself (Milone & MacBroom, Inc. 2010). Aquatic-associated wildlife species found in the vicinity of the project include several species of reptiles and

Figure 3-4. Wastewater Treatment Plant and Outfall Locations



amphibians, such as the gray tree frog (*Hyla versicolor*), wood frog (*Rana sylvatica*), green frog (*Rana clamitans*), spotted salamander (*Ambystoma maculatum*), redback salamander (*Plethodon cinereus*), American toad (*Bufo americanus*), common snapping turtle (*Chelydra serpentina*), and eastern garter snake (*Thamnophis sirtalis*) (FERC 2010).

3.3.1.2.2 Avian and Mammal Species

Bird species typical of open water and emergent and scrub-shrub wetlands can include the red winged black bird (*Agelaius phoeniceus*), belted king fisher (*Ceryle alcyon*), wood duck (*Aix sponsa*), hooded merganser (*Lophodytes cucullatus*), double-crested cormorant (*Phalacrocorax vociferous*), great blue heron (*Ardea herodius*), tree swallow (*Tachycineta bicolor*), and the yellow warbler (*Dendroicapetechia*) (FERC 2010). Barrow's goldeneye (*Bucephala islandica*), a species of waterfowl identified as a state species of special concern, has been reported in the vicinity as part of its winter range (PPL Great Works, LLC. 2000 as reported in Milone & MacBroom 2010). Aquatic and semi-aquatic mammals such as the beaver (*Castor canadensis*), river otter (*Lutra canadensis*), and raccoon (*Procyon lotor*) could also be present in the Penobscot River or surrounding area.

3.3.1.2.3 Fisheries and Mussels

The lower Penobscot River supports resident, anadromous (live in the ocean and breed in fresh water), and catadromous (breed in the ocean), together often referred to as diadromous fish resources. Table 3-2 lists species that could be found in the Penobscot River adjacent to the project site (FERC 2010).

Table 3-2. Species with Potential to be Present in the Penobscot River Adjacent to the Project Site

Common name	Scientific name	Habit*	Origin
Alewife	*Alosa pseudoharengus*	D	Native
American eel	*Anguilla rostrata*	D	Native
American shad	*Alosa sapidissima*	D	Native
Atlantic salmon	*Salmo salar*	D	Native
Atlantic sturgeon	*Acipenser oxyrinchus*	D	Native
Atlantic tomcod	*Microgadus tomcod*	D	Native
Blueback herring	*Alosa aestivalis*	D	Native
Brook trout	*Salvelinus fontinalis*	D	Native
Rainbow smelt	*Osmerus mordax*	D	Native
Sea lamprey	*Petromyzon marinus*	D	Native
Shortnose sturgeon	*Acipenser brevirostrum*	D	Native
Striped bass	*Morone saxatilis*	D	Native
Arctic char	*Salvelinus alpines*	F	Native
Black crappie	*Pomoxis nigromaculatus*	F	Introduced-intracontinental
Eastern blacknose dace	*Rhinichthys atratulus*	F	Native
Bridle shiner	*Notropis bifrenatus*	F	Native
Brook stickleback	*Culaea inconstans*	F	Native
Brown bullhead	*Ameiurus nebulosus*	F	Native
Brown trout	*Salmo trutta*	F	Exotic-intercontinental
Burbot	*Lota lota*	F	Native
Chain pickerel	*Esox niger*	F	Introduced
Common shiner	*Luxilus cornutus*	F	Native
Creek chub	*Semotilus atromaculatus*	F	Native
Creek chubsucker	*Erimyzon oblongus*	F	Native
Emerald shiner	*Notropis atherinoides*	F	Introduced
Fallfish	*Semotilus corporalis*	F	Native
Fathead minnow	*Pimphales promelas*	F	Native
Finescale dace	*Phoxinus neogaeus*	F	Native
Golden shiner	*Notemigonus crysoleucas*	F	Native
Green sunfish	*Lepomis cyanellus*	F	Introduced-intracontinental
Lake trout	*Salvelinus namaycush*	F	Native
Lake whitefish	*Coregonus clupeaformis*	F	Native
Largemouth bass	*Micropterus salmoides*	F	Introduced-intracontinental
Longnose dace	*Rhinichthys cataractae*	F	Native
Longnose sucker	*Catostomus catostomus*	F	Native
Northern pike	*Esox lucius*	F	Introduced-intracontinental
Northern redbelly dace	*Phoxinus eos*	F	Native
Pearl dace	*Margariscus margarita*	F	Native
Pumpkinseed	*Lepomis gibbosus*	F	Native
Redbreast sunfish	*Lepomis auritus*	F	Native
Slimy sculpin	*Cottus cognatus*	F	Native
Smallmouth bass	*Micropterus dolomieui*	F	Introduced-intracontinental
Shortnose sturgeon	*Acipenser brevirostrum*	D	Native
White perch	*Morone americana*	F	Native
White sucker	*Catostomus commersonii*	F	Native
Yellow perch	*Perca flavescens*	F	Native

*D = diadromous; F = freshwater; M = marine.

Fish surveys in 2004 and 2005 in the tailwater behind Great Works Dam identified smallmouth bass as the most abundant species (FERC 2010). Other fish species identified during these surveys include white sucker, American eel, redburst sunfish, fallfish, and common shiner. In 2004 and 2005, one federally and state-listed endangered Atlantic salmon was identified.

Several species of mussels are also known to occur in Penobscot River. Table 3-3 lists mussels commonly found in the vicinity of the proposed project site and results of the survey by Normandeau in 2007 as part of the Dam Removal EA (FERC 2010).

Table 3-3. Mussels Commonly Found in the Vicinity of the Proposed Project Site

Species	Present During 2007 Survey? Great Works Dam
Yellow lampmussel (*Lampsilis cariosa*)	Yes
Tidewater mucket (*Leptodea ochracea*)	No
Creeper (*Strophitus undulatesi*)	Yes
Brook floater (*Alasmidonta varicosa*)	No
Eastern elliptio (*Elliptio complanata*)	Yes
Eastern lampmussel (*Lampsilis radiata*)	Yes
Triangle floater (*Alasmidonata undulata*)	Yes
Eastern floater (*Pyganodon cataracta*)	Yes

The 2007 survey identified a total of six mussel species in areas of Great Works Dam (FERC 2010). Most were identified as eastern elliptio, accounting for more than 97 percent of all mussel observations in the seven areas surveyed. Other species observed were substantially less abundant than the eastern elliptio and included (in decreasing order of abundance) eastern lampmussel; eastern floater; triangle floater; the state-listed threatened yellow lampmussel; and the state-listed species of special concern creeper. Section 3.3.1.3 provides more discussion on special-status mussel species.

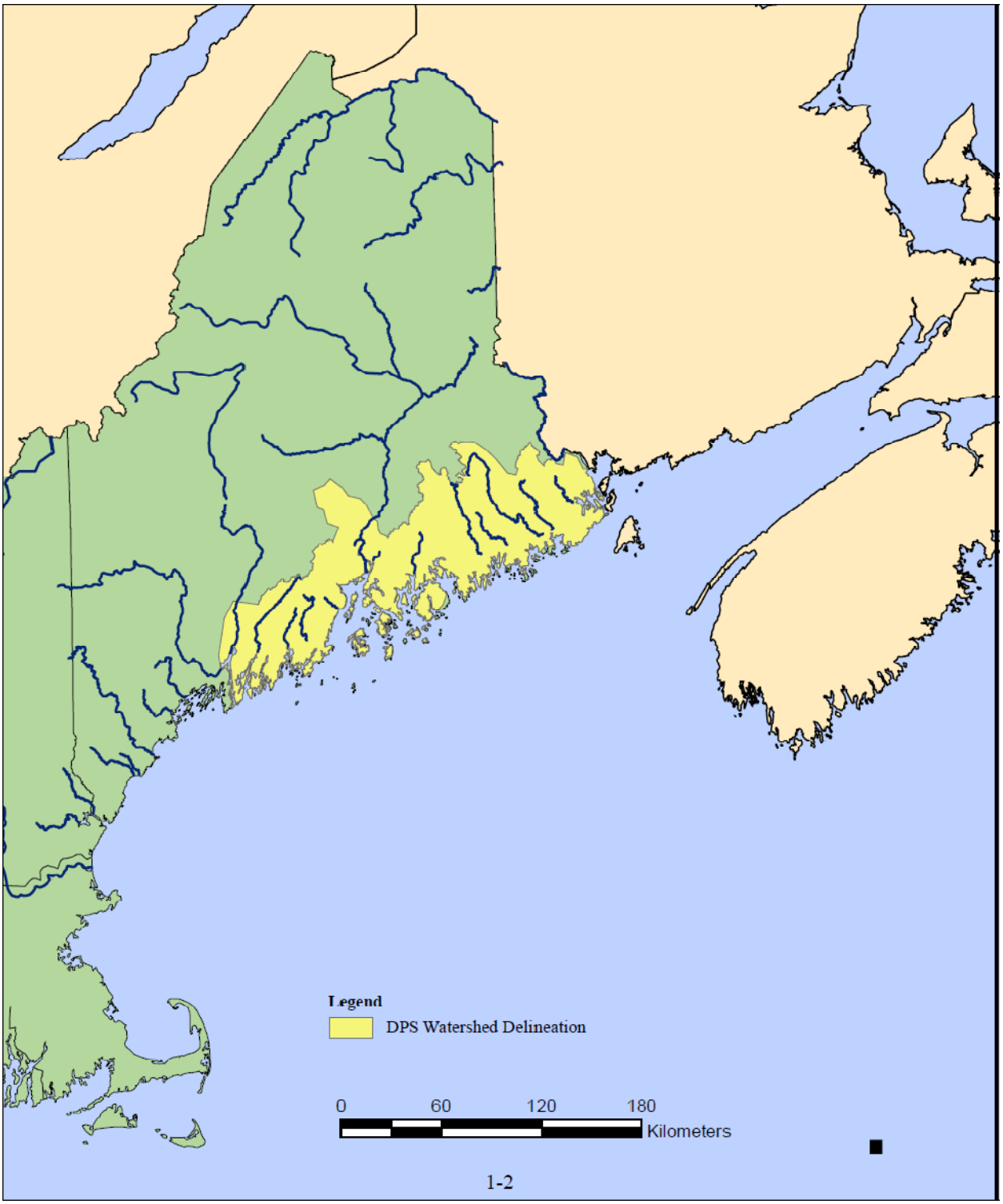
3.3.1.3 Special Status Species

OTFF contacted the FWS and the NMFS on July 13, 2010, via letter regarding the presence of threatened, endangered, or listed species at the pulp mill. The NMFS responded via letter on July 30, 2010 (see Appendix B), stating that two species of fish are listed under the Endangered Species Act as endangered; Atlantic salmon (*Salmo salar*) and shortnose sturgeon (*Acipenser brevirostrum*) are present in the Penobscot River near the pulp mill.

The FWS and the NMFS initially listed the Gulf of Maine DPS of anadromous Atlantic salmon as endangered on November 17, 2000 (65 *Federal Register* [FR] 69459). A subsequent listing as an endangered species on June 19, 2009, expanded the range of the Gulf of Maine DPS of Atlantic salmon (74 FR 29344) (see Figure 3-5). The FWS and the NMFS jointly manage the listed Atlantic salmon, and consultations under Endangered Species Act Section 7 for Atlantic salmon are conducted with both agencies. The Gulf of Maine DPS of Atlantic salmon includes freshwater watersheds from Androscoggin River north along the Maine coast to Dennys River, which includes Penobscot River. There are natural and conservation hatchery populations of Atlantic salmon within this distribution and both are protected under the Endangered Species Act.

Critical habitat in accordance with Endangered Species Act Section 4(b)(2) has been designated for Atlantic salmon and includes the portion of the Penobscot River adjacent to the pulp mill, which is identified as the Great Works Stream-Penobscot River HUC-10 watershed. The primary constituent

Figure 3-5. Geographic Range of Gulf of Maine Distinct Population Segment Salmon



elements of Atlantic salmon critical habitat are (1) spawning and rearing habitat and (2) migration habitat. According to information provided in the Letter of Concurrence issued for the pulp mill water supply intake relocation (FWS 2010), Atlantic salmon could be present in the Penobscot River adjacent to the pulp mill, primarily because:

1. Atlantic salmon spawn and rear infrequently and in limited numbers in Great Works Stream, a tributary of the Penobscot River approximately 500 feet downstream of the project area on the left bank of the river.
2. Approximately 13,500 fry were stocked in Great Works Stream in 2008 as part of a study, and these fish are now rearing in Great Works Stream or Penobscot River.
3. Adults migrate through the reach of the river adjacent to the proposed project from May through November during their upstream migration period.
4. Downstream migrating post-spawned adults pass through the action area, primarily in spring during runoff.
5. Downstream migrating smolts pass through the action area, typically in May as high flows recede.

Shortnose sturgeon were initially listed as endangered on March 11, 1967 (32 FR 4001), prior to enactment of the Endangered Species Act in 1973. The NMFS has sole jurisdiction over shortnose sturgeon; therefore, Section 7 consultation for this species would be under their purview only. It is currently believed that a population of approximately 1,049 individual shortnose sturgeon is present in the Penobscot River downstream of Veazie Dam, which is approximately 7 miles downstream of the pulp mill (see NMFS July 2010 letter in Appendix B). Great Works Dam is directly adjacent to the pulp mill, and this area is the site of the pulp mill's current water supply intake pipe. FERC has authorized Great Works and Veazie dams for decommissioning and removal. The Penobscot Trust is leading the dam decommissioning and removal effort. In December 2009, the NMFS issued its Biological Opinion for decommissioning of the Great Works Project (FERC No. 2312) and Veazie Project (FERC No. 2403) and surrender license and authorization to construct a fish bypass at the Howland Project (FERC No. 2721). The Biological Opinion has paved the way for dam removal, which is anticipated to occur in the next 1 to 2 years. Removing the Great Works and Veazie dams will provide shortnose sturgeon unimpeded access to the portions of the Penobscot River adjacent to the pulp mill site.

Atlantic sturgeon has been petitioned as a candidate species for listing under Endangered Species Act. In 2006, the NMFS initiated a status review for Atlantic sturgeon to determine if listing as threatened or endangered is warranted for this species. The NMFS published a Status Review Report on February 23, 2007 (NMFS 2007). On October 6, 2010, the NMFS published a Proposed Rule that stated the agency has determined that a listing of threatened is warranted for the Gulf of Maine DPS of Atlantic sturgeon. The public had until January 4, 2011, to comment on the Proposed Rule, and the NMFS has indicated they anticipate making their final determination sometime in fall 2011 (Personal Communication, Jeff Murphy, NMFS, April 11, 2011).

OTFF contacted the Maine Department of Inland Fisheries and Wildlife (MDIFW) via letter on July 13, 2010, regarding the presence of state threatened, endangered, or listed species at the pulp mill site. The MDIFW responded via e-mail on July 21, 2010, stating that occurrences of four freshwater mussels, the state threatened yellow lampmussel, tidewater mucket, brook floater, and the Creeper, a state species of special concern, have been identified in the adjacent segment of Penobscot River. In the e-mail correspondence, the MDIFW also stated that no other significant wildlife habitats (as defined under the Maine Natural Resources Protection Act) have been identified at the pulp mill.

The Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-7012) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession,

transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. Bald eagles are included under the MBTA, and are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d). On August 8, 2007, the bald eagle was removed from the list of threatened and endangered wildlife (72 FR 37345, July 9, 2007). Bald eagles have also been removed from the state's list of endangered or threatened species. There is one known bald eagle nest site approximately 1 mile from the pulp mill.

3.3.2 Environmental Consequences of the Proposed Action

3.3.2.1 Upland Areas

Proposed project construction and operations would occur entirely within the boundaries of the existing pulp mill site. Most of the infrastructure would be housed in the existing former tissue mill; therefore, there would be no impacts to upland plant or wildlife species. The storage tanks would be constructed adjacent to the former tissue mill in an area of existing asphalt. Based on the foregoing, there would be no impacts on upland areas or species that could be found in these areas.

3.3.2.2 Aquatic Habitats

In February 2011, OTFF applied for an amendment to the MEPDES permit to include operation of the biorefinery. The submission includes a complete analysis of the addition of the biorefinery to the wastewater treatment plant and its ability to continue to operate within permit limits. Based on this and the 2007 analysis (sec Section 3.3.1.2), it was determined that the existing system has adequate capacity to treat the additional wastewater from the biorefinery while maintaining the system's effluent well within the limits of the existing wastewater discharge permit (see Appendix C). Section 3.2.2.4 provides a complete discussion of wastewater and wastewater treatment as a result of the proposed project.

3.3.2.3 Special Status Species

In July 2010, OTFF received an e-mail response from MDIFW indicating that they do not anticipate any inland fisheries or wildlife concerns associated with the proposed project. Because no alterations of mussel habitat or changes to water-use quantity or quality are proposed, MDIFW anticipates no effects upon freshwater mussels. In addition project construction and operation is not expected to result in disturbance to eagles (see Appendix B).

As part of the OTFF request to the FWS and the NMFS for technical assistance July 2010, OTFF was asked to prepare an analysis of the effluent discharges from the wastewater treatment plant for existing conditions and with the addition of the biorefinery. In February 2011, OTFF submitted to the FWS and the NMFS the *Old Town Fuel and Fiber Proposed Biorefinery Effluent Analysis* (hereinafter, Effluent Report; ICF 2011). On April 4, 2011, the NMFS responded via e-mail and requested some additional analysis be provided, and suggested that DOE initiate informal consultation with submission of the revised Effluent Report. In May 2011, DOE submitted the revised Effluent Report with a request for informal consultation to the FWS and the NMFS via regular mail (see Appendix B).

The analysis in the Effluent Report determined that the anticipated discharge from the OTFF wastewater treatment plant would not alter the pH of the water adjacent to the pulp mill. The reach of the river adjacent to the mill was identified as essential for juvenile migration of Atlantic salmon. Normal pH levels are critical to maintaining this essential feature. The available estimates of effluent composition for the proposed biorefinery suggest that, in general, the change in temperature attributable to the biorefinery would be in proportion to the increase in discharged effluent (5 percent), and therefore considerably less

than 0.1 degree Celsius. That level of thermal loading, as with current conditions, is arguably of little biological significance.

Although all of the surveyed reaches of Penobscot River did not attain designated-use numeric dissolved oxygen criteria[2] during the most recent ambient monitoring, it is likely that the adult migration primary constituent elements for adult salmon would remain fully functioning regardless of the increase in BOD attributable to the change in OTFF wastewater treatment plant effluent following addition of the biorefinery. The dissolved oxygen measured along the Penobscot River is relatively consistent along the full length of the stations assessed in 2007 (see Figure 3-6). The nonattainment of dissolved oxygen, upriver and downriver of the pulp mill, indicates that nonattainment of the numeric dissolved oxygen does not originate with the pulp mill in the middle of the segment.

Although it is not believed that the proposed project would result in increased BOD, the effluent would be monitored in accordance with the MEPDES permit (issued in May 20011), and dissolved oxygen levels would be examined.

The MEPDES permit indicates that proposed project operations would comply with applicable water quality laws and regulations, and provides requirements for continued monitoring of the effluent discharge for temperature, pH, and BOD loading, and continued WET testing.

Based on the Effluent Report and foregoing analysis, DOE determined that the proposed project would not be likely to adversely affect listed fish species or other aquatic species with the addition of the biorefinery to the existing wastewater treatment facility. On June 30, 2011, the NMFS concurred with the DOE determination that the proposed project would not be likely to adversely affect listed or candidate species (see Appendix B). The NMFS made this determination based on current conditions because neither listed shortnose sturgeon nor candidate species Atlantic sturgeon have access to the waterway in the vicinity of the proposed project. On July 21, 2011 the FWS concurred with the DOE determination that the proposed project would not be likely to adversely affect the endangered Atlantic salmon nor would it destroy or result in adverse modification of Atlantic salmon critical habitat (see Appendix B).

3.3.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding to OTFF, OTFF would not construct the biorefinery, and the pulp mill would continue to operate under its existing MEPDES permit. The MEPDES has determined that the pulp mill effluent discharge does not impair the functioning of Penobscot River for adult Atlantic salmon migration or other fisheries.

3.4 Air Quality

This section describes air quality in terms of ambient air quality, odor, and greenhouse gases.

3.4.1 Affected Environment

3.4.1.1 Ambient Air Quality

The Clean Air Act of 1970, as amended (42 U.S.C. 7401 et seq.), empowered the EPA to regulate emissions from stationary, mobile, and area (small stationary) sources, and established National Ambient Air Quality Standards (NAAQS) for “criteria” pollutants that can harm human health or the environment.

[2] These values are given based on the identified uses in that reach of the waterway.

Figure 3-6. Dissolved Oxygen Data Compared to Minimum Criteria in Penobscot River

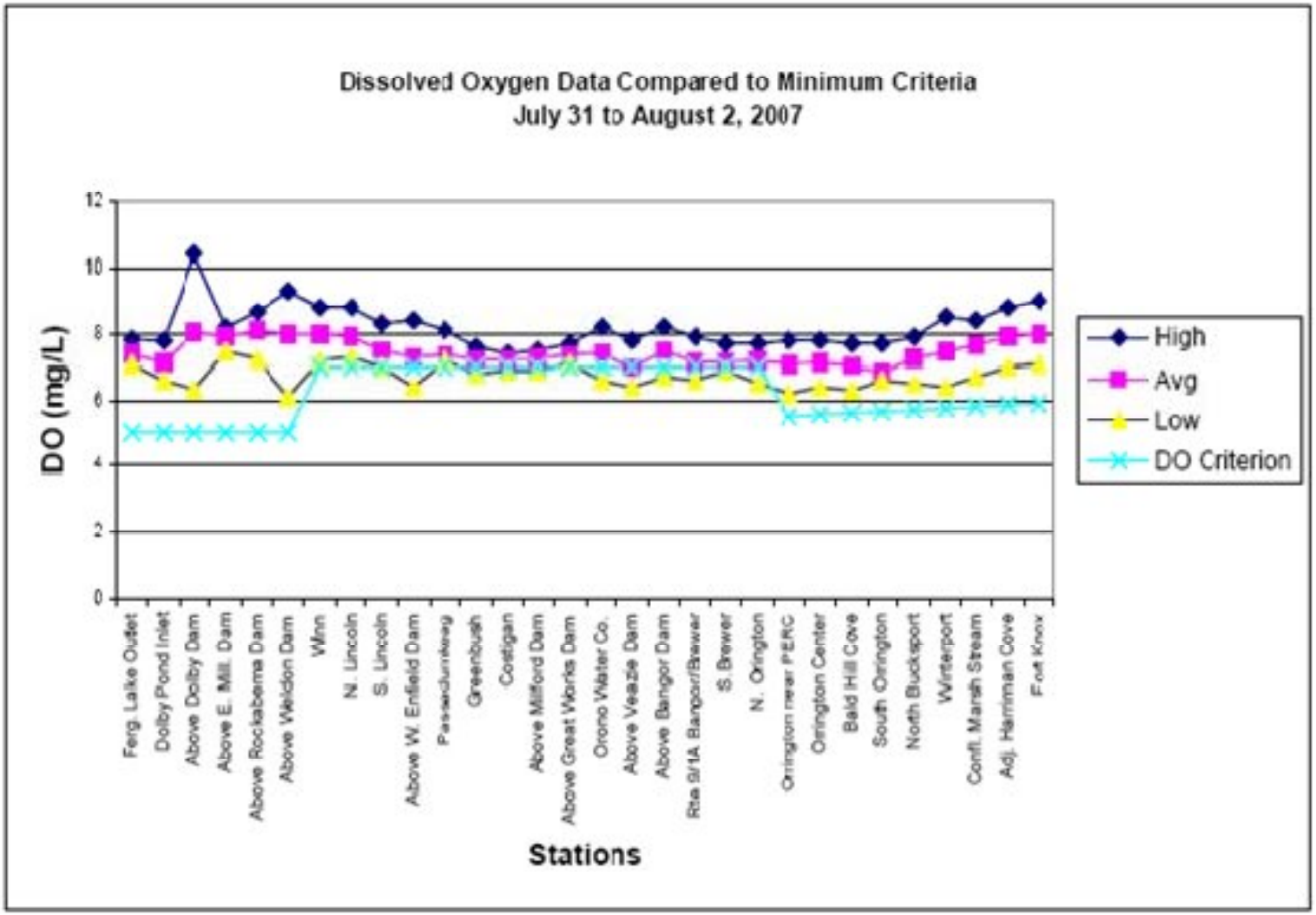


Table 3-4. National Ambient Air Quality Standards[a]

Pollutant	Averaging Periods	Ambient Concentration Standard[b]	Primary or Secondary Standard[c]
Ozone[d]	8 hours	0.075 ppm (147 µg/m^3)	P, S
Carbon monoxide	1 hour	35 ppm (40 mg/m^3)	P
	8 hours	9 ppm (10 mg/m^3)	P
Particulate matter – 10 microns (PM_{10})	24 hours	150 µg/m^3	P, S
Particulate matter – 2.5 microns ($PM_{2.5}$)	24 hours	35 µg/m^3	P, S
	Annual	15 µg/m^3	P, S
Nitrogen dioxide	1 Hour	0.100 ppm (190 µg/m^3)	P
	Annual	0.053 ppm (100 µg/m^3)	P, S
Sulfur dioxide	1 Hour	0.075 ppm (200 µg/m^3)	P
	3 hours	0.5 ppm (1,300 µg/m^3)	S
Lead	Rolling 3-month average	0.15 µg/m^3	P, S
	Quarterly average[4]	1.5 µg/m^3	P, S

a. Source: 40 Code of Federal Regulations 50.
b. ppm = parts per million; mg/m^3= milligrams per cubic meter; µg/m^3 = micrograms per cubic meter.
c. P = primary standard (health-based); S = secondary standard (welfare-based).
d. On January 6, 2010, the U.S. Environmental Protection Agency (EPA) proposed to reduce the 8-hour ozone standard to a level within the range of 0.060 to 0.070 ppm. The EPA expects to issue the revised ozone standard by the end of July 2011.
e. The EPA has revoked the quarterly average lead standard except in areas that have not demonstrated compliance with the standard.

Some NAAQS include both primary and secondary standards, and others include only a primary standard. Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. State air quality agencies enforce the NAAQS. States may choose to adopt their own air quality standards, but state standards must be at least as stringent as the NAAQS. Table 3-4 lists the NAAQS.

Table 3-5 lists the Maine Ambient Air Quality Standards. In addition to the six criteria pollutants designated by the EPA, Maine also has established a standard for chromium.

Table 3-5. Maine Ambient Air Quality Standards[a]

Pollutant	Averaging Periods	Ambient Concentration Standard[b]
Photochemical oxidants (ozone)	1 hour	160 µg/m^3
Hydrocarbons (ozone)	3 hour	160 µg/m^3
Carbon monoxide	1 hour	40 mg/m^3
	8 hours	10 mg/m^3
Particulate matter – 10 microns (PM_{10})	24 hours	150 µg/m^3
	Annual	40 µg/m^3
Nitrogen dioxide	Annual	100 µg/m^3
Sulfur dioxide	3 hours	1,150 µg/m^3
	24 hours	230 µg/m^3
	Annual	57 µg/m^3
Lead	24 hours	1.5 µg/m^3
Total Chromium	24 hours	0.3 µg/m^3
	Annual	0.05 µg/m^3

a. Source: MEDEP 2011b.
b. mg/m^3 = milligrams per cubic meter; µg/m^3 = micrograms per cubic meter.

The EPA evaluates whether the criteria air pollutant levels in a geographic area meet the NAAQS. Areas that violate air quality standards are designated as nonattainment areas for the relevant pollutants. Nonattainment areas are sometimes further classified by degree (marginal, moderate, serious, severe, and extreme for ozone, and moderate and serious for carbon monoxide and particulate matter with an aerodynamic diameter equal to or greater than 10 microns [PM10]). Areas that comply with air quality standards are designated as attainment areas for the relevant pollutants. Areas that have achieved attainment after a period of nonattainment are designated as maintenance areas.

At present, there are no designated nonattainment areas in Maine. Penobscot County, including the pulp mill and project site, is in attainment for all criteria air pollutants (EPA 2011c) and meets the Maine

Ambient Air Quality Standards. The City of Millinocket in Penobscot County is designated as maintenance for sulfur dioxide. Two regions in Maine are designated as maintenance areas for 8-hour ozone: Portland (Cumberland, Sagadahoc, and York counties, and the Town of Durham in Androscoggin County) and the Midcoast (Hancock, Knox, and Lincoln counties, and the Town of Islesboro in Waldo County). One small area, downtown Presque Isle in Aroostook County, is designated as maintenance for PM_{10} (EPA 2011d). The proposed biorefinery would not be in or near any of these maintenance areas.

3.4.1.2 Current Facility Emissions

Under the Title V of the Clean Air Act (42 U.S.C. 7661), large industrial facilities such as the pulp mill are required to hold an operating permit for all of their equipment that emits air pollutants. The pulp mill is operating under existing Title V Air Permit No. A-180-70-AI, December 2, 2009, through December 9, 2014. The pulp mill previously submitted a refined ambient air quality analysis demonstrating that emissions from the facility, in conjunction with all other sources, do not violate ambient air quality standards. The most recent analysis was approved on May 6, 2005. Table 3-6 lists the emissions units the permit addresses.

To control emissions from the process equipment listed in Table 3-6, the pulp mill captures these emissions in the non-condensing gas system rather than venting them. The non-condensing gas system directs these gases to the lime kiln or biomass boiler where they are burned to recover their heat value. Accordingly, air pollutant emissions from process equipment are very small.

The Title V permit sets limits on the allowable emissions from the fuel-burning equipment listed in Table 3-6. Table 3-7 lists the total annual emissions from fuel-burning equipment that are allowed under the permit.

3.4.1.3 Conformity

Clean Air Act Section 176(c) (42 U.S.C. 7506(c)) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan required under Clean Air Act Section 110(a) (42 U.S.C. 7401(a)) before the action is otherwise approved. The purpose of this conformity requirement is to ensure that activities do not interfere with meeting the emissions targets in State Implementation Plans, do not cause or contribute to new violations of NAAQS, and do not impede the ability to attain or maintain NAAQS or delay any interim milestones. The EPA has issued two sets of regulations to implement Clean Air Act Section 176(c): the Transportation Conformity Rules (40 CFR Part 93, Subpart A) and the General Conformity Rules (40 CFR Part 93, Subpart B). The proposed project would be in Penobscot County, which is an attainment area, and would not be in the Millinocket sulfur dioxide maintenance area. Therefore, the conformity requirements and these EPA regulations would not apply to the proposed project.

Table 3-6. OTFF Emission Units Permitted Under 2009 Title V Permit

Emission Unit	Unit Capacity*	Unit Type
No. 5 power boiler	249 MMBtu per hour	Fuel burning, No. 6 fuel oil (0.5 percent sulfur), No. 2 fuel oil for start-up
Biomass boiler	265.2 MMBtu per hour with 16 megawatt condensing turbine	Fuel burning, biomass, construction and demolition wood, supplemental natural gas
Riley power boiler	245 MMBtu per hour	Fuel burning, diesel 0.05 percent sulfur
Gas turbine (Note: This turbine has not operated since 2002. OTFF plans to operate the turbine to provide steam to the biorefinery and electricity for sale. The Maine Department of Environmental Protection has required that the turbine be re-permitted, and OTFF currently is preparing the permit application. See Section 3.4.2 for discussion of emissions from the turbine.)	9.5 megawatt (115 MMBtu per hour)	Fuel burning, natural gas
Chip handling operations	Not applicable	Process equipment
Digester system – impregnation vessel, blow tank, and condensers chip steaming vessel	Supporting pulp production for 2.57 MMlb per day black-liquor solids	Process equipment
Brownstock washer line	Supporting pulp production for 2.57 MMlb per day black-liquor solids	Process equipment
Zaremba multiple effect evaporator	Supporting pulp production for 2.57 MMlb per day black-liquor solids	Process equipment
Unitech multiple effect evaporator	Supporting pulp production for 2.57 MMlb per day black-liquor solids	Process equipment
No. 4 recovery boiler	2.57 MMlb per day black-liquor solids, 375 MMBtu per hour hr firing No. 6 fuel oil, No. 2 fuel oil, diesel fuel and natural gas	Fuel burning
No. 4 smelt dissolving tank	Supporting pulp production for 2.57 MMlb per day black-liquor solids	Process equipment
Recausticizer slaker system	Not applicable	Process equipment
Lime kiln system	64 MMBtu per hour kiln burner	Process equipment
Two fresh lime silos	Not applicable	Process equipment
Reburned lime silo	Not applicable	Process equipment
Salt cake storage silo	Not applicable	Process equipment
Bleach plant system	Not applicable	Process equipment
Chlorine dioxide plant	Not applicable	Process equipment
Pulp Kraft dryer	Not applicable	Process equipment
No. 6 fuel oil tank	30,000 gallons	Process equipment

Table 3-6. OTFF Emission Units Permitted Under 2009 Title V Permit (continued)

Emission Unit	Unit Capacity*	Unit Type
Miscellaneous liquor tanks	Not applicable	Process equipment
Wastewater treatment	Not applicable	Process equipment
Backup diesel engine	1.3 MMBtu per hour	Fuel burning, diesel 0.05 percent sulfur
Backup diesel engine	1.45 MMBtu per hour	Fuel burning, diesel 0.05 percent sulfur
Backup generator for No. 4 turbine	1.2 MMBtu per hour	Fuel burning, diesel 0.05 percent sulfur
Backup diesel fire pump for power house	1.33 MMBtu per hour	Fuel burning, diesel 0.05 percent sulfur
Generator for screw press	4.2 MMBtu per hour	Fuel burning, No. 2 fuel/diesel 0.3 percent sulfur
Backup generator for biomass boiler/condensing turbine	3.52 MMBtu per hour	Fuel burning, diesel, 0.05 percent sulfur

*MMBtu = million British thermal units; MMlb = million pounds.

Table 3-7. Facility Total Licensed Annual Emissions from Combustion[a,b,c] (short tons/year)

Equipment	PM	PM_{10}	SO_2	NO_x	CO	VOCs
Boiler No. 5	87	87	556.2	306	120	55
Biomass boiler	35.0	35.0	29.0	290.3	406.6	19.7
(Nitrogen oxides when firing non-condensable gases in either No. 5 or biomass boiler)	–	–	–	343.4	–	–
Riley power boiler	3.22	3.22	5.64	21.46	3.97	0.2
Gas turbine[d] (existing permit)	1.1	1.1	0.5	20.9	12.8	5.7
No. 4 recovery boiler[e]	177.2	177.2	768.3	812.3	1,396.6	92.4
No. 4 smelt tank	33.07	33.07	14.61	0.28	0.28	0.28
Lime kiln	144.1	144.1	31.1	157.7	357.8	5.3
Total services backup sump pump	0.1	0.1	0.02	1.4	0.3	0.1
Boiler building fire water backup	0.1	0.1	0.02	1.6	0.3	0.1
Pump power house fire backup pump	0.1	0.1	0.02	1.5	0.3	0.1
No. 4 turbine backup generator	0.09	0.09	0.02	1.3	0.3	0.1
Backup generator for biomass boiler	0.1	0.1	0.14	5.1	1.4	0.3
Screw press steam generator	2.2	2.2	5.5	81.1	17.5	6.6
Totals	483.4	483.4	1,754.5	1,700.9	2,318.2	185.9

a. Source: Title V Permit, December 2, 2009.
b. Table does not include process emission units or insignificant activities that have no licensed emission units.
c. CO = carbon monoxide, NO_x = nitrogen oxides; PM = particulate matter; PM_{10} = particulate matter with a diameter equal to or greater than 10 microns; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.
d. Gas turbine annual emissions were calculated with the operating-hour restriction and the pounds-per-hour emission rates given in the Title V permit.
e. No. 4 recovery boiler annual emissions were based on adding the annual emissions from firing oil only to the annual emissions from firing black liquor only.

3.4.1.4 Odor

The pulp mill uses the Kraft process, which converts wood into pulp. In the Kraft process, wood chips are cooked under pressure in a solution containing sodium hydroxide, sodium sulfide, and sodium carbonate. An unavoidable consequence of this cooking is the production of reduced sulfur gases

(typically dimethyl disulfide, dimethyl sulfide, and methyl mercaptan), which can have an offensive odor often perceived as that of "rotting." These reduced sulfur gases from the pulping process (typical of the Kraft pulping process) are currently captured and burnt off in either the lime kiln or boiler at the pulp mill. Odors from these sources vary depending on an individual's smell sensitivity, changes in wind direction, temperature, and mill processing techniques.

3.4.1.5 Greenhouse Gases

The burning of fossil fuels such as diesel, gasoline, and natural gas emits carbon dioxide, methane, and nitrous oxide, which are greenhouse gases. Greenhouse gases can trap heat in the atmosphere and have been associated with global climate change. The Intergovernmental Panel on Climate Change (IPCC), in its Fourth Assessment Report issued in 2007, stated that warming of Earth's climate system is unequivocal, and that most of the observed increase in globally averaged temperatures since the mid 20th Century is very likely due to the observed increase in concentrations of greenhouse gases from human activities (IPCC 2007). Greenhouse gases are well-mixed throughout the lower atmosphere, so any man-made emissions would add to cumulative regional carbon dioxide emissions and to global concentrations of carbon dioxide. The effects from any individual source of greenhouse gases, therefore, cannot be determined. Existing businesses and residences in the Old Town region use fossil fuels, primarily fuel oil, for process operations and space heat. A greenhouse gas inventory has not been developed for the City of Old Town or Penobscot County.

Biogenic carbon dioxide emissions are produced when carbon is released from a source that was created by biological activity that captured carbon dioxide from the atmosphere. Examples of biogenic sources include manufactured biofuels, such as biodiesel and ethanol, and landfill gas, wood, and wood waste. Biogenic sources are considered to be carbon-neutral because they return to the atmosphere carbon that originated there and do not cause a net addition to the carbon dioxide levels in the atmosphere. Biogenic sources may not be considered carbon-neutral if the rate of consumption of the underlying resource (e.g., tree cutting) exceeds the rate of replenishment (e.g., tree growth). Petroleum fuels and natural gas are not considered biogenic. The feedstock for the pulp mill and the proposed biorefinery consists of wood and wood waste, and the forest sources of the facility's feedstock are managed so that the overall rate of tree growth exceeds the rate of tree cutting. Therefore, the carbon dioxide emissions associated with the pulp mill, the biorefinery, and its products are considered biogenic. Because of the distinction between biogenic and anthropogenic (human-caused) emissions, biogenic emissions normally are not included in the impact assessment for projects that use biogenic fuels or feedstocks.

Based on the information in the Title V permit, DOE estimated the existing emissions of greenhouse gases from the pulp mill due to fossil fuel combustion. These emissions are typical of a large-scale facility in the pulp and paper industry. Table 3-8 lists these estimates.

3.4.2 Environmental Consequences of the Proposed Action

The biorefinery would utilize some of the existing equipment (described in Section 2.1.6) at the pulp mill. Additional process equipment would be installed that could emit air pollutants and would be permitted as a minor modification to the existing Title V air permit. Emissions sources for this proposed modification are limited to the acid hydrolysis, fermentation, distillation, product storage, and transfer to transportation operations. Chip handling and preprocessing occur as part of the existing pulp mill operations. All steam requirements would be met either through the HRSG (which operates off waste heat from the natural gas turbine and does not generate any air emissions) or from currently permitted combustion sources.

Table 3-8. Annual Greenhouse Gas Emissions from Fossil Fuel Combustion at Existing Facility[a,b,c] (metric tons per year)

Equipment	CO_2	CH_4	N_2O	CO_2e [d]
Boiler No. 5	171,882	107	426	172,416
Biomass boiler	10,458	29	6	10,493
Riley power boiler	16,192	12	48	16,252
Gas turbine[e] (existing permit)	15,079	29	123	15,231
No. 4 recovery boiler	43,487	27	108	43,622
Lime kiln	44,178	28	110	44,316
Total services backup sump pump	47.55	0.03	0.14	47.72
Boiler building fire water backup	53.03	0.04	0.15	53.23
Pump power house fire backup pump	48.64	0.04	0.14	48.82
No. 4 turbine backup generator	43.89	0.03	0.13	44.05
Backup generator for biomass boiler	128.74	0.09	0.38	129.21
Screw press steam generator	2,755	2	8	2,765
Totals	304,354	235	829	305,418

a. Source: Calculated from data in Title V Permit, December 2, 2009.
b. CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide.
c. Table does not include biogenic emissions (e.g., biomass burning); emissions from firing black liquor or non-condensable process gases because insufficient data are available; or process emission units or insignificant activities that have no licensed emission units.
d. CO_2e = carbon dioxide equivalent; calculated by multiplying the emissions of carbon dioxide, methane, and nitrous oxide by their global warming potentials of 1, 25, and 298, respectively (IPCC 2007), and summing the results.
e. Gas turbine emissions were calculated with the existing operating-hour restriction and the pounds-per-hour emission rates given in the Title V permit.

3.4.2.1 Gas Turbine

As noted in Table 3-6, OTFF is preparing a separate modification to the pulp mill's Title V Permit to allow the turbine and HRSG to operate continuously rather than under the current limitation of 2,628 hours per year. Because the turbine is included in the current Title V permit, only the portion of the potential emissions from the turbine that would exceed the currently permitted levels would be considered an impact of the Proposed Action.

As part of the re-permitting process currently underway for the turbine, the MEDEP requires that emissions be controlled using Best Available Control Technology (BACT). OTFF and the MEDEP currently are defining the emissions control equipment that will be considered BACT. However, it is likely that nitrogen oxide emissions would be controlled using Selective Catalytic Reduction (SCR) or a similar technology, and emissions of other pollutants would continue to be minimized using the existing turbine's combustion technology (lean pre-mixed dry low emission) and the use of natural gas fuel. Although the efficiency of nitrogen oxide control for the turbine are not yet known, SCR is an established emission control technology that routinely achieves reductions of 90 percent or more in nitrogen oxides. Using the assumption of 90 percent reductions, the emissions of the re-permitted turbine as it would operate after the biorefinery started operating can be estimated for illustrative purposes. Table 3-9 lists the estimated emissions of criteria pollutants from the gas turbine. The illustrative BACT scenario shown in Table 3-9 would result in a net reduction in nitrogen oxide emissions compared to the currently permitted levels. The data in Table 3-9 are estimates developed for the purposes of this EA. The final BACT requirements are not yet known.

Table 3-9. Estimated Annual Emissions of Criteria Pollutants from Gas Turbine (short tons per year)[a]

Description	Annual Operational Hours	PM	PM_{10}	SO_2	NO_x	CO	VOCs
Originally permitted maximum (from Title V permit, see Table 3-6)[b]	2,628	1.1	1.1	0.5	20.9	12.8	5.7
Current conditions (no operation)	0	0	0 0 0 0 0				
After re-permitting, before application of required BACT[c]	8,760	3.32	3.32	1.71	49.87	7.56	1.06
After re-permitting, with illustrative BACT scenario for NO_x[d]	8,760	3.32	3.32	1.71	4.99	7.56	1.06
Change with BACT compared to current conditions	8,760	3.32	3.32	1.71	4.99	7.56	1.06

a. Calculated with the existing operating hour restriction and the pounds-per-hour emission rates given in the Title V permit.
b. CO = carbon monoxide, NO_x = nitrogen oxides; PM = particulate matter; PM_{10} = particulate matter with an diameter equal to or greater than 10 microns; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.
c. Calculated based on AP-42 emission rates (EPA 2000). These emission rates differ from those given in the Title V permit.
d. Illustrative BACT scenario assumes 90 percent nitrogen oxide reduction, and no further control of other pollutants.

Table 3-10 lists the estimated emissions of greenhouse gases from the gas turbine. The increase in operating hours with the re-permitting would result in an increase in greenhouse gas emissions.

Table 3-10. Estimated Annual Emissions of Greenhouse Gases from Gas Turbine[a,b] (metric tons per year)

Description	Annual Operational Hours	CO_2	CH_4	N_2O	CO_2e [c]
Calculated based on data in current Title V permit	2,628	15,079	29	123	15,231
Current conditions (no operation)	0	0	0	0	0
After re-permitting	8,760	50,264	149	30	50,443
Change after re-permitting compared to current conditions	8,760	50,264	149	30	50,443

a. CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide.
b. Illustrative BACT scenario does not affect greenhouse gas emissions.
c. CO_2e = carbon dioxide equivalent, which is calculated by multiplying the emissions of carbon dioxide, methane and nitrous oxide by their global warming potentials of 1, 25, and 298, respectively (IPCC 2007), and summing the results.

3.4.2.2 Biorefinery Process Emissions

Table 3-11 lists the proposed process equipment. No additional fuel-burning equipment would be installed for the biorefinery.

When considering the air pollutant emissions from the biorefinery, it is important to understand that the feedstock for the biorefinery (i.e., the extract) is diverted from the input to the existing pulping process. OTFF estimates that pulp production would decrease by 1 percent with the biorefinery operating. Therefore, while there would be air emissions that from the biorefinery, the emissions from the pulp mill would decrease slightly as a result of the reduction in pulp yield (chips minus extract).

Table 3-11. OTFF Process Emission Units to be Permitted for Biorefinery[a]

Emission Unit	Type of Equipment/ Process	Maximum Raw Material Process Rate (name and rate)[b]	Maximum Finished Material Process Rate (name and rate)[b]	Control Device
Bio1	Biomass extraction. Condensers, reactors	464 GPM	122 GPM	c
Bio2a	Acids recovery	Extract 24 MGY	Acetic acid 2.55 MGY	c
Bio2b	Acids recovery	Extract 4 MGY	Formic acid 0.74 MGY	c
Bio2c	Acids recovery	Extract 4 MGY	Furfural 0.08 MGY	c
Bio3a	Fermentation/Distillation	Extract	n-butanol 1.3 MGY	Scrubber
Bio3b	Fermentation/Distillation	Extract	Acetone 0.45 MGY	Scrubber
Bio3c	Fermentation/Distillation	Extract	Ethanol 0.04 MGY	Scrubber

a. Source: OTFF 2011a.
b. GPM = gallons per minute, MGY = millions of gallons per year.
c. The control devices for the biomass extraction and acids recovery processes involve collection of these emissions by the non-condensing gas system and transporting them to the lime kiln or the biomass boilers, where they would be burned.

As in the pulp mill, most of the flows from the air emission points in the biorefinery would be collected and directed to the non-condensing gas collection system and burned in the lime kiln or biomass boiler to recover their heat value. These emissions are currently being directed to the non-condensing gas system; however, when a portion of the feedstock is diverted from the pulp mill to the biorefinery, these emissions would arrive at the non-condensing gas systems from locations at the biorefinery. In other words, biorefinery emissions would be offset by a corresponding decrease in pulp mill emissions. Those biorefinery emissions that are not routed to the lime kiln or the biomass boiler would be controlled using a wet scrubber. All process vents of condensable gases would be equipped with condensers to minimize emissions. Table 3-12 lists the estimated total emissions from proposed project operations.

Table 3-12. Estimated Total Process Emissions from Biorefinery[a,b]

Pollutant	Source Operations	Emissions (short tons per year)
Volatile organic compounds	Refinery processes, fugitive emissions, product storage, and transfers of product to trucks for shipping	21
Hazardous air pollutants (estimated to be 97 percent acetaldehyde)	Refinery processes, fugitive emissions, product storage, and transfers of product to trucks for shipping	3.2
Carbon dioxide	Fermentation	7,500 (6,234 metric tons per year)
Particulate matter – 10 microns (PM_{10})	Refinery processes and product transfers	1.5

a. Source: OTFF 2011b.
b. Emissions are from the new biorefinery only and do not account for potential decreases in emissions from the pulp mill.

Emissions from proposed project construction would be minor because most of the project would be in the former tissue mill. Minimal excavation would be required. Emissions of fugitive dust during construction would be minimized through standard practices, such as minimizing the size of exposed soil areas and the duration of exposure, watering or chemically treating exposed soil surfaces and roadways, and seeding or mulching exposed soil surfaces.

3.4.2.3 Conformity

The proposed project is in Penobscot County, which is an attainment area, and is not in the Millinocket sulfur dioxide maintenance area. Therefore, the conformity requirements would not apply to the proposed project.

3.4.2.4 Odor

Under normal operating conditions the proposed project would not produce odors beyond those that currently exist at the pulp mill. Under process upset conditions, the potential odor sources from the project would be in the fermentation system, the pressed lignin and gypsum, and the wastewater treatment plant. Potential odors from the fermentation system would be caused by volatile organic compounds or reduced sulfur compounds. The sulfur compounds that typically might cause these odors are those such as dimethyl disulfide, dimethyl sulfide, and methyl mercaptan. Wastewater treatment can generate volatile organic compounds and hydrogen sulfide. Carbon dioxide is emitted from combustion processes, pretreatment and refining processes (e.g., fermentation and distillation), and molecular sieves units. The biorefinery could produce certain vented emissions that might or might not create an odor; these would be individually addressed. Hydrogen sulfide gas (which has a foul smell like rotten eggs) or butyric acid (which also has an unpleasant smell) could occur intermittently under upset conditions or when maintenance or cleaning procedures are initiated. Hydrogen sulfide has a defined permissible exposure limit threshold for personnel exposure (20 parts per million ceiling limit; OSHA 1910.1000, Table Z-2) and would be managed to this level. Butyric acid, although known to cause irritation when inhaled, has no OSHA permissible exposure limit.

Preventative maintenance and best operations practices would be the primary method to control these compounds and related odors. Compounds that are vented from the proposed project process through vents, including those that might cause odor are managed by using either a wet scrubber or destruction by burning in the boiler. VOCs, which are soluble in water, would be controlled by the wet scrubber. Wastewater treatment odors would be controlled through following OTFF operating procedures and maintaining an adequate dissolved oxygen content in the system. The addition of biorefinery would not be anticipated to require additional treatment for odor or result in impacts from additional odors. An odor impact is not expected to the balance of the pulp mill site or surrounding community.

The recovered gypsum separated after acid hydrolysis (produced in the biorefinery at a rate of 24.1 tons per day) would be sent to Juniper Ridge Landfill. Under wet, anaerobic conditions, such as those that often occur in landfills, some of the sulfate from the gypsum would dissolve into the water and produce hydrogen sulfide. An active landfill gas collection system is installed and operational at the Juniper Ridge Landfill to control odors. The landfill uses two types of covers, in conjunction with the active gas collection system, to manage the landfill gas and minimize odors: a daily cover and an intermediate cover (a compacted soil or synthetic cover). In addition to the active landfill gas collection system, the Juniper Ridge Landfill uses an odor neutralizing system as a backup system to help minimize odors. The odor neutralizing system consists of a high-pressure pump that releases a non-toxic chemical through a series of misting nozzles. When operating, this system continuously sprays an odor neutralizing agent that combines with, and neutralizes, odor-causing molecules.

The disposal of 33.8 tons per day of gypsum is not expected to cause any odor impact at the landfill or to the nearby residents.

3.4.2.5 Greenhouse Gases

The biorefinery would generate greenhouse gases, primarily from the fermentation process. Fermentation is a biogenic source of carbon dioxide emissions. Biogenic sources are natural sources of carbon dioxide in which living organisms or biological processes produce emissions. As shown in Table 3-12, proposed project operations are estimated to produce 6,234 metric tons (7,500 short tons) of carbon dioxide per year. (This total does not include carbon dioxide produced by the burning of natural gas in the turbine, which is being permitted separately from the biorefinery, as discussed above.) The additional carbon dioxide emissions due to the biorefinery would represent only a small fraction of the facility's existing greenhouse gas emissions (see Table 3-10).

As discussed above, the feedstock for the biorefinery is taken entirely from the feedstock for the pulp mill, and the total feedstock received by the entire facility would remain constant. Therefore, the project would change the carbon flows within the facility boundary, but would not change the amount of carbon that leaves the facility. Carbon would leave the facility in three main forms:

- Wood pulp as at present, to be made into paper products, which would defer emissions of the carbon content for at least the life of the product
- Biofuels, which would release their carbon content as carbon dioxide upon combustion of the biofuels
- Process emissions of greenhouse gases to the atmosphere

Therefore, the project would not change the ultimate fate of the carbon in the end products, but would only shift the emissions of carbon dioxide to earlier in time, compared to the fate of the current wood pulp products. However, to the extent that use of the biofuel products would displace combustion of fossil fuels, the project would result in a net benefit in reducing greenhouse gas emissions from fossil fuels. Similarly, to the extent that electricity produced by the gas turbine and sold by OTFF would displace electricity generated by higher-emitting fossil fuels such as oil or coal, the gas turbine re-permitting would result in a net benefit in reducing greenhouse gas emissions from fossil fuels.

Greenhouse gas emissions from the gas turbine would increase by 50,443 metric tons per year (55,603 short tons per year) of carbon dioxide equivalent after re-permitting, as shown in Table 3-10. The carbon dioxide emissions due to the re-permitted gas turbine would come from fossil fuels, but would represent only a small fraction of the facility's existing greenhouse gas emissions (305,318 metric tons per year of carbon dioxide equivalent).

Greenhouse gas emissions from proposed project construction would be minimal because the biorefinery would be in an existing building, and little excavation would be required.

The CEQ has issued draft guidance on when and how federal agencies should consider greenhouse gas emissions and climate change under NEPA (CEQ 2010). The CEQ draft guidance includes a presumptive effects indicator level of 25,000 metric tons per year (approximately 27,600 short tons per year) of carbon dioxide-equivalent emissions from an action. The CEQ draft guidance states, "[If] a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2-equivalent GHG [greenhouse gas] emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public… CEQ does not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis for agency actions involving direct emissions of GHGs."

Greenhouse gas emissions for the proposed project, including the gas turbine would be 57,943 metric tons per year of carbon dioxide equivalent, which would exceed the CEQ indicator level. For comparison the pulp mill currently generates 305,418 metric tons CO_2e per year; with the addition of the proposed project, this number would increase by 19 percent. However, this increase represents an extremely small fraction of national and global emissions, and in this context would have a negligible impact on global climate change.

3.4.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding and OTFF would not build the biorefinery and associated facilities. There would be no impacts to air quality from proposed project construction and operations and the pulp mill would continue its current operations.

3.5 Aesthetics

This section describes the visual/aesthetic resources in the vicinity of the proposed project and the potential impacts to these resources from the Proposed Action and No-Action Alternative.

3.5.1 Affected Environment

The proposed project site is within the boundaries of existing pulp mill site at 24 Portland Street in Old Town, Maine, and is on a bend on the western side of Penobscot River. The City of Old Town has zoned the area for industrial use, and the area has several large industrial buildings to the east of South Main Street along the western banks of Penobscot River. Adjacent properties are primarily zoned residential, and homes are present primarily along South Main Street and face the pulp mill. There are also residences to the north and south of the project site along South Main Street. Directly opposite the pulp mill along the eastern bank of Penobscot River there are residences present primarily on Main Street in Bradley. Forest Hills Cemetery is to the northwest on South Main Street.

Because the proposed project site has a historical use as an industrial facility, it is heavily developed with existing buildings, paved/gravel access and circulation areas, and areas for materials storage. Current operations on this property include wood chip storage and handling, pulping, bleaching, drying, maintenance, warehousing, fuel storage, and black-liquor storage.

The OTFF wastewater treatment plant is on approximately 23 acres of land directly west of the pulp mill across South Main Street along Penny Road. The treatment system consists of an aeration pond, spill pond, four clarifiers, and control building.

3.5.2 Environmental Consequences of the Proposed Action

The proposed biorefinery would require 0.9 acre in the 5.7-acre former tissue mill. The six material storage tanks proposed to be constructed on the east side of the former tissue mill would vary from 8 feet to 14 feet in diameter and range from 13 feet to 18 feet in height measured from ground elevation. In addition, 13 proposed towers and columns would extend above the roofline of the proposed biorefinery (former tissue paper machine) building. These towers and columns would range from 20 inches to 7.5 feet in diameter and vary in height from 25 feet to 100 feet above the building's floor elevation, and there would be 12-foot by 14-foot structural steel frames around 5 of the columns. A 10-by-15-foot pump house would be built to use in conjunction with the new cooling tower cell.

The buildings surrounding the proposed biorefinery building would function to minimize the visibility of the proposed project; however, the proposed distillation columns and tanks would be visible to drivers on

both sides of the river. Trucks and vehicles entering and leaving the site associated with construction activities would result in short-term visual impacts to residents and drivers. However, given the industrial nature of the project site and surrounding land, and the temporary duration of construction activities, this would not adversely affect visual resources.

The biorefinery would be contained in the former tissue mill, but newly constructed external facilities would not be fully blocked from the view of surrounding residents. Some of the newly constructed towers and columns would be taller than the surrounding existing buildings on the site, but no proposed tower or column would exceed 70 feet above roofline (see Figure 3-7). The proposed outdoor-related facilities like the tanks, HRSG, pump house, and cooling tower cell required for biorefinery operations would not result in a significant change to the existing visual quality of the project site and surrounding area, because newly constructed facilities would be similar to the already developed nature of the site. In addition, they would not be visible to drivers passing by. Also, considering that the pulp mill has been in operation for more than 100 years and given the industrial nature of the project site, adverse impacts to visual/aesthetic resources would not be expected. Therefore, adverse changes to the visual/aesthetic quality of the project site and surrounding area, if any, would not be expected.

3.5.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding and OTFF would not build the biorefinery and associated facilities. There would be no short-term impacts to visual/aesthetic resources, surrounding residences, or drivers from construction activity, and the pulp mill would continue its current operations.

3.6 Safety and Occupational Health

This section describes safety and occupational health at the pulp mill, available emergency and medical services, and potential impacts to safety and occupation health from the proposed project.

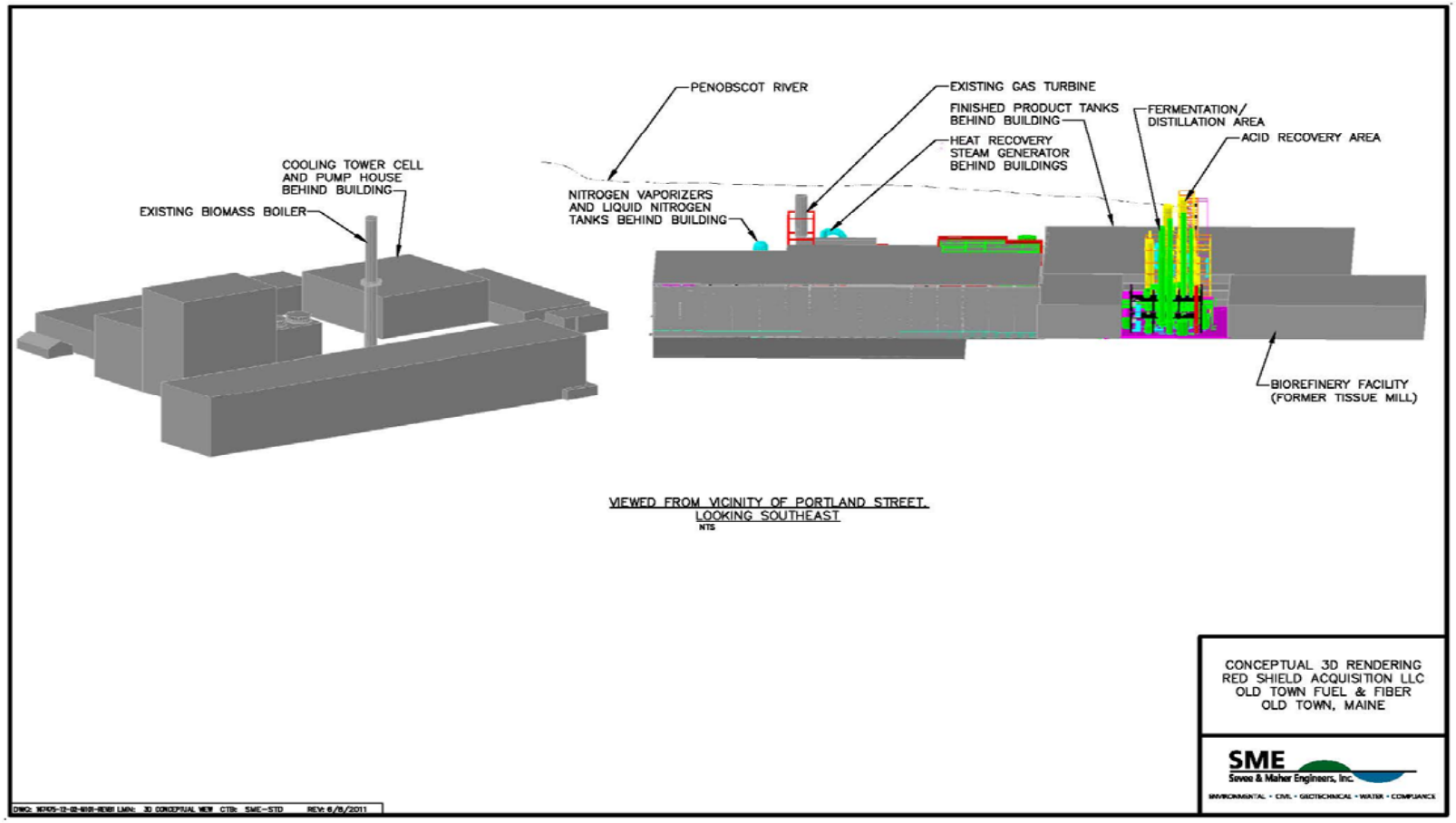
3.6.1 Affected Environment

Potential hazards present at the pulp mill are those common to industrial activities, including trip and fall hazards, hazardous materials spills, worker exposure to hazardous materials, fire, industrial and vehicle accidents, drowning, and confined spaces. The existing pulp mill operates within established health and safety plans and procedures, which comply with applicable Occupational Health and Safety Administration, the EPA, and State of Maine regulations. The Emergency Response Plan, SPCC Plan, Health and Safety Plan, and OTFF Wastewater Treatment Plant Operation and Maintenance Manual contain sections on safety considerations, which outline potential safety hazards that could be present and precautions to ensure worker safety. Some of the hazards include personal injury, electrical, mechanical, and chemical handling, drowning, and confined spaces.

The City of Old Town Police Department and Fire Department provide emergency services for the pulp mill. The Fire and Police departments are at the City of Old Town Public Safety Facility at 150 Brunswick Street, approximately 1.4 miles northwest of the pulp mill. Fire Department services include confined-space rescue and hazardous materials mitigation response.

Hospitals in the City of Bangor, approximately 15 miles from Old Town, provide medical services, including a 24-hour-a-day emergency department with ambulance and air transportation. Medical centers in Bangor also have rehabilitation services that provide occupational and physical therapy.

Figure 3-7. Conceptual Three-Dimensional Rendering of the Proposed Biorefinery



3.6.2 Environmental Consequences of the Proposed Action

The chemicals and chemical processes used to produce n-butanol create a potential for health and safety hazards. Section 3.7 describes the hazards related to hazardous materials storage and handling. In summary, hazardous materials generally fall into one of two categories: flammable or reactive. Most of the chemicals proposed to be used in the biorefinery are already being used on the site at the pulp mill; the sole exception is ethyl acetate. N-butanol is flammable and many of the process chemicals are reactive (that is, acids or bases). Storing and handling hazardous materials have the potential for releases to the environment. A catastrophic release of hazardous materials could affect the public. A spill of n-butanol could catch fire. A spill of acid or caustic material could present a hazard if a member of the public came into contact with the liquid.

The most likely hazardous material release at the proposed project would be an accidental release at a bulk storage (tank) location. To prevent a catastrophic accident from affecting the public, OTFF would design and construct storage tanks outside the former tissue mill with secondary containment structures large enough to hold the contents of the largest tank plus sufficient additional volume for precipitation (rain or snow), as required by EPA regulations (40 CFR 112). Any tanks inside the building containing regulated material (for example sulfuric acid) would also have secondary containment. As appropriate, the proposed facility would comply with the standards in the National Fire Protection Association 30, Flammable and Combustible Liquids code.

Secondary containment would limit the movement of a spilled liquid. OTFF would develop or update appropriate spill response, pollution prevention, emergency action, and emergency response plans to address the medical and environmental hazards that could affect the public, employees, and the environment. The plans would include, at a minimum, a hazard communication plan, an SPCC Plan, an SWPPP, an Emergency Action Plan, and an Emergency Response Plan. OTFF would complete the plans in accordance with federal and Maine Occupational Safety and Health Administration, MEDEP, and EPA regulations and guidance. These plans would:

- Analyze the potential for spills or releases of n-butanol and other hazardous materials. This analysis would include spills or releases from equipment failures, human error, natural disasters, and intentionally destructive acts.
- Outline steps to prevent releases or spills.
- Evaluate the potential impacts of releases if they occurred.
- Describe response actions OTFF would take in the event of a release.
- Describe procedures to follow in the event of fires or explosions, tornados, severe weather, medical emergencies, or bomb threats.
- OTFF would adhere to the hazard mitigation protocol in the OTFF Wastewater Treatment Plant Operation and Maintenance Manual.
- OTFF would meet with local fire and emergency response providers to discuss potential emergencies, determine capabilities, and establish communications protocols and responsibilities. In addition, OTFF would establish safety and emergency response procedures for construction activities, electrical, hazardous chemicals, hot work permits, fall prevention, proper equipment usage, confined space entry, fire protection and prevention, and hearing and respiratory protection for employees, contractors, and visitors. OTFF would design the fire protection systems for the proposed project to protect the public, limit personal injury to employees, and limit property loss and plant downtime from a fire or explosion. Storage tanks that would contain flammable materials would be designed and constructed in accordance with the National Fire Protection Association standards.

The project would have the following fire protection systems:

- Fire hydrant/hose stations – The facility would have adequate numbers of fire hydrants and hose stations to ensure sufficient coverage of the process areas as designated by National Fire Protection Association standards and City of Old Town building codes. There are several yard hydrants throughout the pulp mill site, and the nearest hydrants are less than 500 feet from the proposed site improvements.
- Local Fire Protection Service – OTFF would rely on the local fire department or emergency response teams in the event of a serious fire. These authorities would be familiar with the layout of the n-butanol facilities, the hazards of materials handled on the premises, places where personnel would normally work, and possible evacuation routes. OTFF would develop a Fire Protection Plan for the plant and update it to detail the proposed project information necessary to ensure the use of safe and effective firefighting measures at the plant.

In addition to fire hydrants and foam systems, the plant has hand-held fire extinguishers, temperature detectors, smoke detectors, and other fire-detection devices required by local fire codes or the Office of the State Fire Marshal. DOE expects the existing emergency response capabilities of the City of Old Town and Penobscot County to remain in place and available to OTFF, if needed.

As part of the application process for amendment of the OTFF Site Location Development Act Permit, the City of Old Town requested that the city's Fire Chief review and comment on the fire protection adequacy at the site and on the OTFF Emergency Response Plan. Further, a fire protection engineer retained by the City of Old Town would perform a peer review of the OTFF amendment application. All outdoor tanks would be registered with the Office of the State Fire Marshal, which would regulate all flammable materials present on the site.

3.6.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding and OTFF would not build the biorefinery. The potential hazards related to the industrial activity on OTFF property would not change. The No-Action Alternative would have no effect on existing emergency response capabilities of the City of Old Town or Penobscot County.

3.7 Waste Management and Hazardous Materials

This section describes current OTFF practices for solid and hazardous waste management and hazardous materials handling.

3.7.1 Affected Environment

3.7.1.1 Solid and Hazardous Waste Management

The primary waste materials from the pulp mill consist of wastewater sludge (20 dry tons per day), knots and pulping rejects (4 to 5 wet tons per day), and small amounts of miscellaneous mill trash. The wastewater sludge and the ash are disposed of at the Juniper Ridge Landfill and miscellaneous trash is transported to the Penobscot Energy Recovery Company. The pulp mill is a small-quantity generator (i.e., it generates 100 kilograms, but less than 1,000 kilograms of hazardous waste per month). Hazardous wastes are limited to small amounts of laboratory waste, aerosol cans, and paint products. Occasional pulping process upsets result in the release of hazardous waste that is collected and managed in accordance with applicable regulations. The disposal of such wastes depends on the type of waste

generated; it would be hauled off the site by a contractor and disposed off in accordance with applicable regulations.

3.7.1.2 Hazardous Materials Handling

Table 3-13 lists hazardous materials OTFF currently uses on the site.

Table 3-13. Hazardous Materials OTFF Currently Uses on the Site*

Hazardous Chemical	Maximum Quantity on the Site (pounds)	Primary Storage/Use Location
No. 2 fuel oil	31,000	No. 2 boiler/No. 5 boiler
No. 6 fuel oil	829,000	Bulk storage tank, fuel for recovery furnace, No. 5 boiler
Black liquor	2,097,000	Digester, recovery furnace
Eco-Brite 1400	22,400	Bleachery
Lime mud	3,600,000	Liquor prep
Calcium oxide	400,000	Liquor prep
Chlorine dioxide	19,900	Oxides of chlorine plant, bleachery
CC 265	17,100	Bleachery
CC 270	12,700	Bleachery
Chutebrite J	13,500	Kraft machine
Diesel fuel	100,000	Vehicle fuel
Gasoline	12,500	Vehicle fuel
Gencoag 100N	62,500	Wastewater treatment plant
Green liquor	7,500,000	Recovery furnace, liquor preparation
Hydrochloric acid	10,100	Liquor preparation
Hydrogen peroxide	95,000	Bleachery, oxides of chlorine plant
Aerotech 4218	15,800	Kraft machine
Aerotech 6016	91,700	Digester
Mistron 100	83,600	Bleachery
Nalco 1826	32,000	Boiler feedwater
Nalco 71315	48,700	Wastewater treatment plant
Nalco 7191 Plus	73,800	Wastewater treatment plant
Nalco 8158	53,000	Boiler feedwater
Nalco Nexguard 22312	15,100	Boiler feedwater
Nalco PP07-3803	28,000	Wastewater treatment plant
Oxygen	72,200	Bleachery
Propane	20,000	Forklifts
Silicone Transformer Oil	142,000	Mill transformers
Sodium chlorate	1,291,000	Oxides of chlorine plant
Sodium chloride	99,000	Boiler feedwater
Sodium Hydroxide	525,000	Liquor preparation, oxides of chlorine plant, digester
Sodium sulfate	51,000	Oxides of chlorine plant
Sulfuric acid	288,000	Oxides of chlorine plant, Kraft machine, wastewater treatment plant
Urea-APP Solution	91,700	wastewater treatment plant
Weak Wash	623,000	Liquor prep
White liquor	8,900,000	Liquor preparation, digester

* Source: Tibbets 2011.

3.7.2 Environmental Consequences of the Proposed Action

3.7.2.1 Solid and Hazardous Waste Management

Gypsum produced from the reaction of sulfuric acid and calcium hydroxide, which is used to allow for the removal of the acetic and formic acids, and the excess lime, would be removed as a waste product at a rate of approximately 33.8 dry short tons per day. This waste product would be trucked to the Juniper Ridge Landfill, a state-owned construction and demolition debris landfill at 2828 Bennoch Road, Old Town (City of Old Town 2011a). The Juniper Ridge Landfill has a total permitted capacity of 10.28 million cubic yards and a tonnage rate of approximately 50,000 tons per month (Sevee and Maher Engineers 2011, Bangor Daily News 2010). Juniper Ridge Landfill received a total of 709,198 tons of waste in 2010. At projected fill rates, the present licensed capacity should provide 9 years of disposal capacity, consuming that capacity in 2018 (Maine State Planning Office 2011).

In late 2006, the Juniper Ridge Landfill operator began its initial investigation into expanding the landfill to provide an additional 21.9 million cubic yards of disposal capacity. In late 2009, a public benefit determination application was submitted as part of the expansion process. The MEDEP issued a draft denial decision on that application, stopping the planned expansion process. Discussions are currently underway with the MEDEP to evaluate next steps, and a public benefit determination application is expected to be resubmitted at some point in the future. If approved as proposed, an expansion couldprovide an additional 18 to 20 years of landfill disposal capacity (Maine State Planning Office 2011). There is a commercial landfill (Crossroads) that could also be used if Juniper Ridge were to close. Crossroads Landfill is approximately 50 miles from Old Town.

The lignin recovered from the extract after acid hydrolysis would be sent via aboveground pipeline back to the pulp mill, where it would be combined with the lignin removed from the pulp in the Kraft pulping process and burned in the boiler to recover the heat value. Ethanol produced at a rate of 18,000 gallons per year and furfural produced a rate of 106,000 gallons per year would also be sent to the boiler via pipeline to recover the heat value.

OTFF would remove the existing first-floor composite concrete slab for the installation of new tanks. The concrete debris, mixed with rebar, would be transported to the Juniper Ridge Landfill (approximately 1,200 cubic feet). During biorefinery operations, the wastewater treatment plant would generate approximately 48 dry tons per day of sludge compared to 20 dry tons per day currently generated. Like the current disposal practice, this sludge would be disposed of at the State of Maine licensed special waste landfill.

The proposed project and the existing pulp mill would share the same administrative offices. Administrative operations for the proposed project would generate very little additional paper waste and very little additional nonhazardous solid wastes, such as scrap metal, wood, plastic products, paper from plant operations, and empty containers (drums, totes, and boxes). As it does now, OTFF would recycle its waste paper to the extent practicable, and would dispose of nonhazardous solid waste in the Juniper Ridge Landfill in Old Town, Maine.

Under normal operations, the biorefinery would not generate any hazardous wastes. Occasional biorefinery upsets could result in the release of hazardous waste that would be collected and managed in accordance with existing mill procedures. The OTFF biorefinery would generate universal wastes, including used oil, fluorescent and high-intensity discharge light bulbs, and batteries. Depending on the types of universal wastes generated, a licensed universal waste transportation company for that particular type of waste would transport such materials to a licensed disposal facility.

3.7.2.2 Hazardous Materials Handling

The proposed project would store and use various hazardous materials. OTFF would use materials compatible with the contents being stored to build each storage tank. As stated in Section 3.6.2, outdoor storage tanks would have secondary containment structures capable of holding the largest tank volume plus additional volume for rainfall. Any tanks inside the building containing regulated material (for example sulfuric acid) would also be in secondary containment. The proposed six exterior storage tanks would store the following products at the maximum capacities identified:

- N-butanol storage tank (30,000 gallons)
- Acetone storage tank (10,000 gallons)
- Lime storage silo (1,900 cubic feet)
- Nitrogen storage tank (11,000 gallons)
- Acetic acid storage tank (39,000 gallons)
- Formic acid storage tank (16,000 gallons)

Section 3.6.2 discusses the plans OTFF would develop to address environmental hazards associated with the proposed project. OTFF would provide spill response training to employees working with hazardous materials. These measures would reduce the likelihood of spills of such materials. Therefore, DOE anticipates the measures would minimize the potential impacts as a result of the proposed project.

3.7.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding and OTFF would not build the biorefinery. There would be no generation of new waste and no on-site use of new hazardous materials. OTFF would continue to generate solid and hazardous waste in the same quantities it does now.

3.8 Utilities

This section describes the utilities in place and municipal systems used, including electricity, natural gas, potable water, process water, process wastewater, and domestic wastewater, for the existing pulp mill. It also describes potential impacts to utilities resulting from the Proposed Action and No-Action Alternative.

3.8.1 Affected Environment

OTFF uses approximately 15 MW of electricity generated from biomass and recovery boilers currently in operation at the site. When OTFF is unable to generate sufficient quantities of electricity, the balance is made up by pushing power from Bangor Hydro Electric Company.

Bangor Gas provides natural gas for the City of Old Town and OTFF. There is an existing on-site connection that provides OTFF with natural gas, which is used for the lime kiln and the boilers. OTFF gas usage ranges from 1,200 decatherms in summer to 1,600 decatherms in winter.

Process water is currently supplied from the pulp mill process water system and is treated through coagulation and filtration. The water is derived from Penobscot River, and the pulp mill currently removes and uses 28 million gallons per day from the river.

OTFF is connected to the City of Old Town municipal water system, which provides OTFF with potable water. OTFF domestic wastewater discharges to the City of Old Town sanitary sewer. The sanitary sewer discharges to the City of Old Town municipal wastewater treatment plant. The present municipal wastewater treatment plant capacity is 4.6 million gallons per day at peak flow. The average daily production is 1.5 million gallons per day (City of Old Town 2011b). The plant discharges secondary treated wastewater to Penobscot River, and an unspecified quantity of untreated combined sanitary and stormwater from combined sewer overflow outfalls to Penobscot River and Stillwater River under permit No. ME01000471 (MEDEP 2011a).

3.8.2 Environmental Consequences of the Proposed Action

Electricity for the proposed project would be generated from biomass and recovery boilers currently in operation at the site. Due to the addition of the biorefinery, less material would be sent to the recovery boiler because this material would be used in the biorefinery. An existing gas turbine (not currently operational) would be utilized to generate 9.5 MW of power. An additional 2.5 MW of power, generated by the gas turbine, would be required to operate the biorefinery. The remaining 6.9 MW of power would be sold on the open market.

OTFF would provide steam for the biorefinery production process. Steam would be generated from the biomass and recovery boilers currently in operation at the pulp mill. The new HRSG associated with the existing gas turbine would supply 45,000 pounds per hour of steam; the balance of the steam necessary for the biorefinery would be made up by the existing boilers. Steam use would increase by 116,000 pounds per hour; it would be reduced by the recovery of heat equivalent to 17,000 pounds per hour of steam.

Process water would be supplied from the pulp mill process water system, which previously fed the building where the biorefinery would be housed. Expected consumption of process water for the biorefinery facility would be 965,000 gallons per day plus 13 million gallons per day of cooling water, for a total of 13.9 million gallons per day. For services requiring a more constant temperature and to reduce overall water consumption, a closed-loop cooling circuit would be utilized. The existing biomass boiler cooling towers would be expanded by a cooling tower cell (outside the proposed biorefinery building) to increase capacity to account for additional head load from the surface condensers. A total of 104 million British thermal units of cooling capacity would be required. All process wastewater would discharge to the existing OTFF wastewater treatment plant.

Potable water provided by the City of Old Town municipal water system would be used in the biorefinery for employee needs. The biorefinery would use approximately 320 gallons per day of domestic water and wastewater generated, based on 16 full-time employees and the average daily water consumption and wastewater use. Impacts to the City of Old Town municipal water system would be very small because this would represent a very small increase compared to current usage. The Old Town Water District serves the communities of Old Town, Bradley, and Milford for residential and business customers, with an annual distribution of 378,546,000 gallons. This averages to a little over 1,000,000 gallons per day.

3.8.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding and OTFF would not build the biorefinery. There would be no generation of new waste and no on-site use of new hazardous materials. OTFF would continue to generate solid and hazardous waste in the same quantities it does now.

3.9 Cultural Resources

This section provides describes cultural resources in the vicinity of the proposed project and potential impacts to those resources from the Proposed Action and the No-Action Alternative. The National Historic Preservation Act of 1966 (NHPA; 36 CFR 800), as amended, is the primary federal law protecting cultural, historic, Native American, and Native Hawaiian resources. NHPA Section 106 (36 CFR 800.3) requires DOE and other federal agencies that have lead jurisdiction over a federal undertaking (i.e., a project, activity, or program that is funded by a federal agency or that requires a federal permit, license, or approval) to assess and determine the potential effects of their proposed undertakings on historic properties. Historic properties mean any prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on, the *National Register of Historic Places* maintained by the Secretary of the Interior. This term also includes artifacts, records, and remains related to and located within such properties, and properties of traditional religious and cultural importance to an Native American tribe or organization that meet the National Register listing criteria (36 CFR Part 60).

The intent of Section 106 is for federal agencies to consider the effects of a proposed undertaking on historic properties through a consultation process that includes the identification of historic properties and consultation with State Historic Preservation Officers, federally recognized Native American tribes, the Advisory Council on Historic Preservation, applicants for federal assistance, local governments, and any other interested parties.

3.9.1 Affected Environment

DOE reviewed the National Register for listed historic properties in Penobscot County. There are 102 historic properties in the Penobscot County, six of which are in Old Town. There are no listed historic properties within a 1-mile radius of the pulp mill (NRHP 2010). There are 107 identified archaeological sites within the City of Old Town, primarily associated with the Penobscot Indian Nation (FERC 2008). All of these sites are situated along the banks of Penobscot and Stillwater rivers and their tributary streams.

The pulp mill was originally a sawmill that began producing pulp in 1882, and by 1883, expanded into a sulfite pulp mill. The pulp mill has largely been in operation since that time and is currently owned and operated as the pulp mill. Most of the pulp mill buildings and structures that comprise the pulp mill site are post-1970 industrial structures and warehouses.

3.9.2 Environmental Consequences of the Proposed Action

There are no National Register-listed sites within the construction footprint of the proposed project or near the pulp mill. OTFF proposes to construct on an existing industrial site where there is limited potential for historic properties. Most of the mill buildings and structures that comprise the pulp mill are circa 1970 industrial structures and warehouses with no architectural distinction. As a continuously operating mill, there have been numerous modern additions to the mill, and the mill as it exists today does not retain the features of the original late 19th Century mill. There are some extant buildings more than 50 years of age; however, the mill site itself does not retain the historic integrity needed to be considered for inclusion on the National Register.

Most of the proposed construction would be within the existing former tissue mill. Ground disturbance associated with the proposed project would take place in areas subject to previous and ongoing ground disturbance from extensive activities related to pulp manufacturing. The potential for significant archaeological sites is limited given the extensive previous soil disturbance.

The former tissue mill in which the proposed biorefinery would be constructed is a modern addition to the mill complex. The mill complex itself has undergone extensive changes over the past century and the addition of a biorefinery, which would not alter the size or scale of the complex, would have no effect on the setting of the area or create visual effects that could impact cultural resources.

The nearest National Register-listed historic property is more than 1 mile away from the pulp mill, and the pulp mill itself is not likely to be considered eligible for National Register listing. The proposed project would not affect any historic properties. DOE initiated Section 106 consultation with the Maine Historic Preservation Commission (which is the State Historic Preservation Office), Penobscot Indian Nation, the Aroostook Band of Micmac Indians, the Houlton Band of Maliseet Indians, the Passamaquoddy Tribe, and the Pleasant Point Reservation of the Passamaquoddy in a letter dated June 10, 2011 (see Appendix B). The letter included a proposed finding of "No Historic Properties Affected" for the Proposed Action. On June 17, 2010 DOE received a letter of concurrence on this finding from the Maine Historic Preservation Commission, which concludes DOE obligations under Section 106. If construction activities encountered archaeological resources, ground-disturbing activities would stop and OTFF would contact the Maine Historic Preservation Commission for resolution and further instruction on additional studies or potential mitigation measures required in accordance with the NHPA.

3.9.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding to OTFF, and OTFF would not build and operate the proposed biorefinery. There would be no new construction at the proposed site. Under this alternative, there would be no impacts to cultural resources at the proposed site.

3.10 Traffic

3.10.1 Affected Environment

Currently the pulp mill receives approximately 555 trucks, 910 passenger vehicles, and 42 rail cars per week (OTFF 2011c). Figure 3-8 shows the regional road and rail network in and near Old Town, Maine. Figure 3-9 shows the local transportation network in the immediate vicinity of the pulp mill. There is one main access into the pulp mill via Portland Street, which connects to U.S. Route 2 (South Main Street) approximately 5 miles east of Interstate 95. The nearest entrance to Interstate 95 is at Stillwater Avenue, 3 miles from the pulp mill.

Pan Am Railways owns and operates a line that runs from Mattawamkeag in Penobscot County, through Old Town to Portland, and then continues to Massachusetts. This rail line runs adjacent to the pulp mill.

Truck traffic to the pulp mill predominantly uses Interstate 95, exiting at Stillwater Avenue in Orono. Trucks then travel northeast on Stillwater Avenue, a two-lane arterial that connects Orono and Old Town, and crosses Penobscot River. On portions of Stillwater Avenue traveling through commercial areas in Orono and Old Town, the road has a center turn lane. There are two traffic signals on Stillwater Avenue providing access to commercial developments within 0.2 mile northeast of the Interstate 95/Stillwater Avenue interchange. Other traffic signals on the primary truck route on Stillwater Avenue include signals at the intersections of Benoch Road, College Avenue/Old Mill Road, at Old Mill Elementary School, and near Sanford Avenue (providing access to commercial development). Truck traffic travels northeast approximately 2.5 miles on Stillwater Avenue until it reaches the unsignalized intersection of Stillwater Avenue and Center Street. Truck traffic turns right on Center Street and travels approximately 0.5 mile east to the intersection with South Main Street, a signalized intersection. Center Street is a two-lane road without a center turn lane. Once trucks turn right on South Main Street, they travel approximately 1.25

Figure 3-8. Regional Road and Rail Network in and Near Old Town, Maine

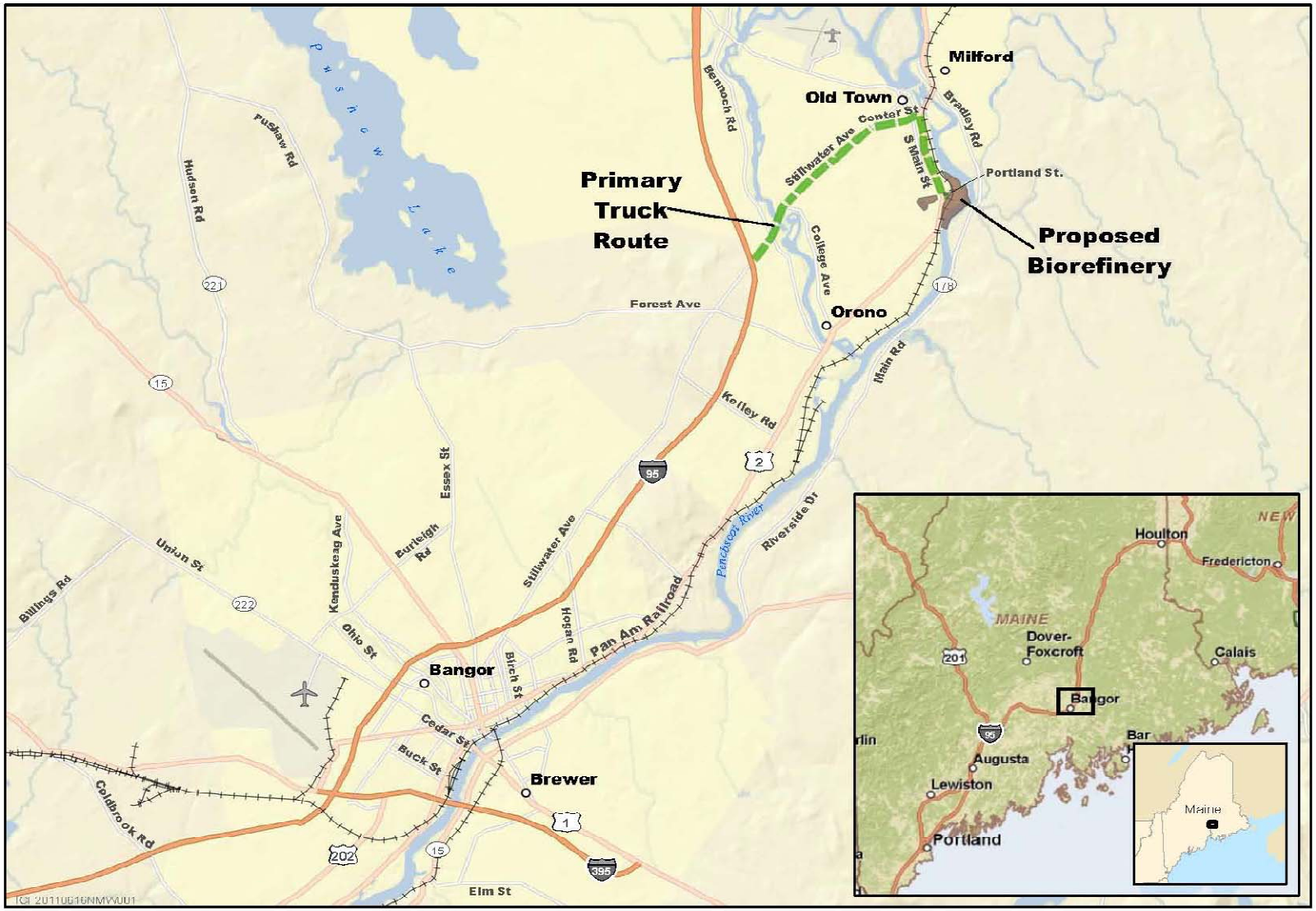
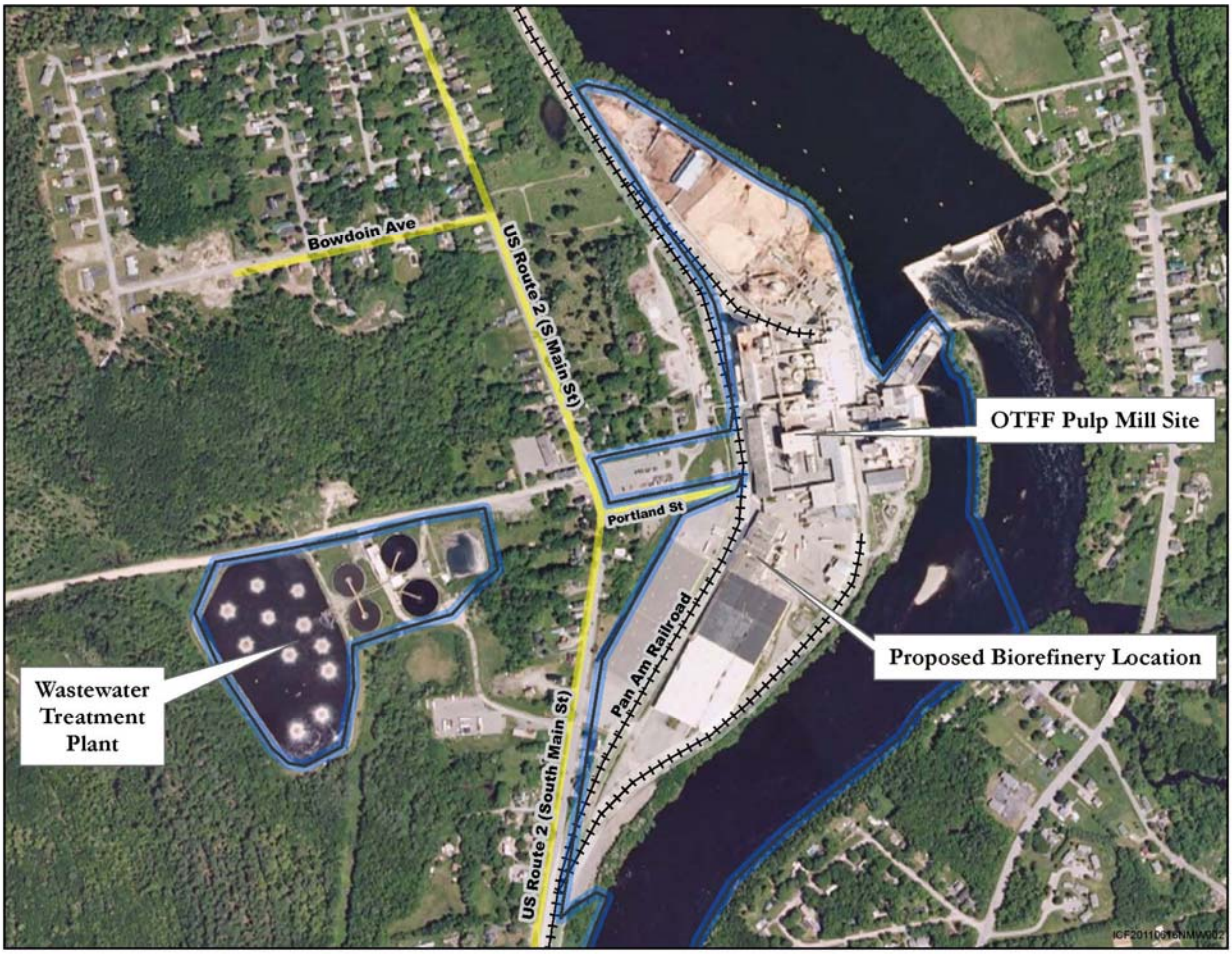


Figure 3-9. Local Transportation Network in the Immediate Vicinity of OTFF



miles south to Portland Street. South Main Street is a two-lane arterial. There are no signals or stop signs between the intersection of Center Street and the pulp mill. Trucks make a left turn on to Portland Street, a local access road that ends at the pulp mill site, less than 0.1 mile east of the intersection with South Main Street. Table 3-14 identifies the average annual daily traffic on roadway segments between Interstate 95 and the pulp mill.

Table 3-14. Existing Condition Traffic Volumes*

Location	Average Annual Daily Traffic in Both Directions	Year
Stillwater Avenue NE of Interstate 95 Northbound Ramps (Orono)	19,340	2009
Stillwater Avenue at Orono/Old Town City Limits	18,100	2008
U.S. 2A (Stillwater Avenue) Southwest of U.S. 2A (Center Street)	16,430	2008
U.S. 2A (Center Street) West of Main Street	11,720	2009
U.S. 2 (South Main Street) South of U.S. 2A (Center Street)	6,820	2009
U.S. 2 (South Main Street) South of Bowdoin Avenue	7,290	2008

*Source: Maine Department of Transportation, 2009 Transportation Count Book.

Roadway capacity is defined as the maximum number of vehicles that can be served by the roadway section. In this case for South Maine Street (a two-lane arterial), the capacity is estimated at approximately 800 vehicles per hour per lane using industry standard methods (Florida DOT 2009).

3.10.2 Environmental Consequences of the Proposed Action

3.10.2.1 Construction

Construction trucks would transport materials used to construct the biorefinery at the pulp mill site. These materials would include concrete, steel, piping, rebar, construction equipment, and building materials such as siding, roofing, and windows. Although these materials can be obtained from a variety of locations, it is likely most construction trucks would arrive at the Interstate 95/Stillwater Avenue interchange from the south, coming from the Bangor metropolitan area, which is south of the Interstate 95/Stillwater Avenue interchange.

Proposed project construction would temporarily increase the amount of automobile and truck traffic due to construction workers and deliveries to the facility. No new roads would need to be constructed for construction trucks to access the site.

Construction trucks would predominantly use the truck route from Interstate 95 to the pulp mill site described in Section 3.10.1 for delivery of construction materials. For the approximately 14-month construction period, approximately 100 trucks trips per week, or 20 truck trips per day would travel to and from the pulp mill site on this truck route.[3] This level of additional truck traffic on the Stillwater Avenue portion of the truck route represents an 0.1 percent increase in traffic on this corridor based on a review of traffic volumes listed in Table 3-14. Construction truck traffic would represent an estimated 0.2 percent increase in truck traffic to the project site compared to existing conditions on the South Main Street segment of the truck route. This level of traffic increase would not generate any traffic operations issues, because the roadway would continue to operate well below the estimated capacity of 800 vehicles per hour per lane.

OTFF estimates that the approximately 80 construction workers hired locally would generate an additional 800 passenger vehicle trips[4] per week at the pulp mill site during the 14-month construction period. This translates to 160 construction worker vehicle trips per day generated during the duration of the construction period (assuming a 5-day construction work week). Construction workers would arrive at the pulp mill site from a variety of locations. However, because the major population center in the region surrounding the pulp mill site is in Bangor south of the project site, it is assumed that most construction worker traffic would come from the south using Interstate 95 or arterials such as South Main Street to reach the pulp mill site. Assuming all construction worker traffic used the same truck route described in Section 3.10.1 as a worst-case scenario, construction worker traffic would generate an estimated increase of 0.8 percent in average daily traffic volume on the Stillwater Avenue portion of the truck route, and approximately 2.2 percent increase on the South Main Street portion of the route using traffic volumes identified in Table 3-14. Again, this level of traffic increase would not generate any traffic operations issues, because the roadway would continue to operate well below the estimated capacity of 800 vehicles per hour per lane.

[3] Based on the OTFF estimate of 50 trucks per week (OTFF 2011c). Assuming an average 5-day per week construction work week would make 10 construction-related trucks visiting the site each day. Fifty trucks per week make 100 truck trips per week (one trip entering the site and one trip leaving the site), or 20 truck trips per day.
[4] Based on the OTFF estimate of 400 construction worker vehicle trips per week (OTFF 2011c). Four hundred vehicles per week make 800 vehicle trips per week (one trip entering the site and one trip leaving the site).

3.10.2.2 Operations

Biorefinery operations would not generate additional truck or rail traffic to provide raw materials for the biorefinery. Existing truck traffic providing woodchips for the pulp mill would also provide the raw materials used for biorefinery operations. However, operations would produce several by-products and waste products that would need to be transported out of the pulp mill site, generating additional truck and/or rail traffic from the pulp mill site. At this time, OTFF has not determined which mode of transportation to use for the saleable products, including n-butanol, acetic acid, formic acid, or acetone, produced on the project site. Therefore, this analysis addresses both options. Note that if OTFF transported one product by truck, it would not transport that product by rail, and vice versa.

3.10.2.2.1 Trucks and Automobiles

Gypsum, sulfuric acid, sodium hydroxide, lime, and ethyl acetate would all be transported from the project site by truck. Table 3-15 lists the estimated truck trips per week to transport these products.

Table 3.-15. Estimated Weekly Truck Trips Resulting from Operation of Biorefinery[a]

Product	Estimated Truck Trips Per Week	Estimated Truck Trips Per Day[b]
n-Butanol	4	0.6
Acetic acid	7	1
Formic acid	3	0.4
Acetone	1	0.1
Gypsum	14	2
Sulfuric acid	9	1.3
Sodium hydroxide	2	0.3
Lime	3	0.4
Ethyl acetate	0.5[c]	0.1
Totals	43.5	6.2

a. Source: OTFF 2011d.
b. Daily truck trips are based upon an average seven-day per week biorefinery operation.
c. One truck per month, or two truck trips per month.

Because OTFF has not decided which mode of transportation to use for saleable products, estimates were made assuming one mode or the other for transporting these products. Estimates are based on communications with OTFF personnel.

As shown in Table 3-15, biorefinery operations could generate 43.5 trucks trips per week under a scenario in which OTFF transported n-butanol, acetic acid, formic acid, and acetone by truck instead of rail. Truck traffic would be expected to use the truck route identified in Section 3.10.1 between the Interstate 95/Stillwater Avenue exit and the project site. Most of the by-products and waste products transported by truck from the project site would be transported to destinations south on Interstate 95. As noted in Table 3-15, operations would result in an average of six trucks per day on the truck route, which represents less than a 0.1 percent increase in truck traffic on the South Main Street portion of the truck route, and a much smaller fractional increase in truck traffic on the Stillwater Avenue portion of the truck route, where average daily volumes are close to 18,000 vehicle trips per day under existing conditions. This level of traffic increase would not generate any traffic operations issues, because the roadway would continue to operate well below capacity.

During operations, the biorefinery would require a permanent work force of approximately 16 employees, which the surrounding area's population and skilled personnel could support. Biorefinery operations

would result in an estimated increase to the site of 224 vehicle trips per week, or 32 vehicles per day. The additional work force would likely be hired from the local area, and would arrive at the site from a variety of locations. However, because most of the Bangor metropolitan area population is south of the pulp mill site, it is likely that most of this traffic would arrive at the pulp mill from the south. Assuming that all employees operating the biorefinery traveled on the truck route described in Section 3.10.1, average daily traffic volumes on the Stillwater Avenue portion of the truck corridor would increase by 0.2 percent and on the South Main Street portion of the truck corridor by 0.5 percent compared to existing conditions. This level of traffic increase would not generate any traffic operations issues, because the roadway would continue to operate well below capacity.

3.10.2.2.2 Rail

As described above in Section 3.10.2.2, OTFF has an option of transporting the saleable products by rail instead of truck. Transportation by rail would occur on the Pan Am Railways line that runs between Mattawamkeag through Old Town, to Portland, Maine, to the south. As shown in Table 3-16, biorefinery operations could result in up to 8 additional rail cars at the site per week, creating up to 16 rail car trips per week (8 inbound and 8 outbound). Pan Am Railways, the owner and operator of the rail infrastructure on and near the project site indicates that the increase in rail traffic identified in Table 3-16 would not create rail yard or rail line capacity issues (Personal Communication, Doug Steward, Pan Am Railways, June 16, 2011). The rail line generally parallels roads with few rail crossings in Old Town, south of the project site. Existing rail crossings are gated with rail signals. An additional 16 rail car trips per week would not be anticipated to greatly increase rail crossing delays compared to existing conditions or to create any safety issues (Personal Communication, Doug Steward, Pan Am Railways, June 16, 2011).

Table 3-16. Estimated Weekly Rail Car Trips Resulting from Biorefinery Operations[a]

Product	Estimated Rail Car Trips Per Week	Estimated Rail Car Trips Per Day[b]
n-Butanol	4	0.6
Acetic acid	8	1.1
Formic acid	2	0.3
Acetone	2	0.3
Totals	16	2.3

a. Source: OTFF 2011c.
b. Daily truck trips are based on an average 7-day-per-week biorefinery operation.

3.10.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding to OTFF, and OTFF would not build the biorefinery. There would be no increase in vehicle or rail traffic under the No-Action Alternative.

3.11 Socioeconomics and Environmental Justice

3.11.1 Affected Environment

3.11.1.1 Environmental Justice

Executive Order 12898 (*Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, February 11, 1994) directs federal agencies to identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies, and

activities on minority populations and low-income populations." In implementing Executive Order 12898 in the context of NEPA, a lead agency must determine whether a proposed action would have any disproportionately high or adverse human health or environmental effects on low-income or minority populations compared to impacts on the general population.

CEQ guidance for implementing Executive Order 12898 in the context of NEPA (*Environmental Justice. Guidance under the National Environmental Policy Act*, December 10, 1997) identifies a minority population as an affected area where more than 50 percent of the population belongs to a minority group or where the percentage presence of minority groups is meaningfully greater than in the general population.

The proposed project site is in Census Tract 71 of Penobscot County, Maine, on the west bank of Penobscot River. Just across the river lies Census Tract 80.01 of Penobscot County. Both census tracts are included in the affected area for the purpose of this environmental justice analysis, as are the City of Old Town and Penobscot County as a whole.

Table 3-17 lists the minority presence as a share of the total population in Census Tracts 71 and 80.01, the City of Old Town, Penobscot County, and in the area of comparison, the State of Maine. The presence of American Indians in the affected area is considerably higher than the presence of American Indians in the State of Maine. There is also a higher percentage of Asians in Old Town and of individuals of two or more races in Old Town and Census Tract 71. There are slightly more individuals of any minority race or ethnicity in Census Tract 71 and in Old Town than in the State of Maine as a whole. Because the share of any specific minority in the total population in any affected area is small and the total minority presence reaches at most 7.6 percent (in Old Town city), compared to 5.6 percent in the State of Maine, DOE does not consider the minority presence in the affected area as meaningfully greater than in the area of reference for the purpose of this environmental justice analysis. No minority populations, as defined in the CEQ guidance for implementation of the Executive Order 12898, were identified.

Table 3-18 lists the presence of individuals with low income as a share of the total population in Census Tracts 71 and 80.01, the City of Old Town, Penobscot County, and in the area of comparison, the State of Maine. Low-income presence is approximately 80 percent higher in Old Town than in the State of Maine, reaching 22.7 percent of the total population of Old Town. Low-income presence in Census Tract 71, the location of the proposed project, is almost 70 percent higher than in the State of Main as a whole, and reaches 21.4 percent of the total population. These numbers are also at least 45 percent higher than in the rest of Penobscot County. Because these shares are not only considerably higher than in the State of Maine, but also are over 20 percent of the local population, DOE considers Census Tract 71 and the City of Old Town to be low-income populations for the purposes of this environmental justice analysis.

3.11.1.2 Socioeconomics

CEQ NEPA implementing regulations state that economic and social effects of alternatives should be analyzed in NEPA documents when they are interrelated with natural or physical effects, and that the human environment to be analyzed should be interpreted comprehensively to include the relationship of people with the natural and physical environment (40 CFR 1508.14).

The proposed project site is in Old Town, Penobscot County, Maine. For purposes of analyzing potential socioeconomic impacts of the Proposed Action and the No-Action Alternative, the relevant affected area is that within commuting distance of the site, because it would be the area where biorefinery construction and operations workers would likely reside and expend a considerable share of their resources. The Office of Management Budget defines Metropolitan Statistical Areas based on commuting ties, and defines Penobscot County as constituting the Bangor Metropolitan Statistical Area, Bangor being its

Table 3-17. Minority Presence[a]

Geography	Total Population	Percent of Total Population								
		White	Black or African American	Alaska Native or American Indian	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino[b]	Total Minority Race or Ethnicity[c]
Census Tract 71	5,054	94.3	0.7	1.7	0.8	0.1	0.2	2.2	1.2	6.4
Census Tract 80.1	4,562	96.2	0.4	1.4	0.4	0.0	0.2	1.3	0.3	3.9
Old Town	7,840	93.1	0.9	1.6	1.8	0.1	0.3	2.2	1.3	7.6
Penobscot County	153,923	95.4	0.8	1.2	0.9	0.0	0.2	1.5	1.1	5.3
Maine	1,328,361	95.2	1.2	0.6	1.0	0.0	0.3	1.6	1.3	5.6

a. Source: U.S. Census Bureau 2010a.
b. Individuals who identify as Hispanic, Latino, or Spanish may be of any race; the sum of the other percentages under the "Percent of Total Population" columns plus the "Hispanic or Latino" column therefore do not equal 100 percent.
c. Minority population, for the purposes of this analysis, is the total population for the U.S. Census designated place minus the non-Latino/Spanish/Hispanic white population.

Table 3-18. Low-Income Presence*

Geography	Population with Income Below Poverty Level	Percent Share of Total Population
Census Tract 71	1,088	21.4
Census Tract 80.1	454	9.9
Old Town	1,745	22.7
Penobscot County	20,742	14.7
Maine	161,582	12.6

*Source: U.S. Census Bureau 2010b.

largest city, approximately 15 miles to the south of the proposed project site (OMB 2009). For purposes of this socioeconomics analysis, the affected area is Penobscot County (Bangor Metropolitan Statistical Area).Penobscot County has a population of 153,923 (U.S. Census Bureau 2010a) and as of 2009, per capita personal income was $33,767, as compared to $36,547 in the State of Maine as a whole (BEA 2011). As of April 2011, Penobscot County had an estimated labor force of 78,334 and an unemployment rate of 8.1 percent (6,353 residents) (BLS 2011). Approximately 5,120 workers were estimated to be employed in construction in Penobscot County in 2009, and 4,795 in manufacturing (BEA 2011).

3.11.2 Environmental Consequences of the Proposed Action

3.11.2.1 Environmental Justice

The existence of disproportionately high and adverse human health and environmental effects depends on the existence in the affected area of minority or low-income populations and on the existence of significant impacts of the proposed project.

To identify and address disproportionately high and adverse human health or environmental effects on minority or low-income populations, DOE adopted the following analytical process:

1. For purposes of the environmental justice analysis, identify the affected area.
2. Characterize the affected area regarding the presence of minority and low-income populations. In doing so, and following CEQ guidance, identify areas were where (a) minority or low-income presence exceeds 50 percent, or (b) minority or low-income presence is meaningfully greater than the percentage presence in the general population or other appropriate unit of geographic analysis.

3. Assess potentially high and adverse human health or environmental effects described in other resource sections of this EA.
4. If other resource sections identify significant impacts, determine whether there would be disproportionately high and adverse impacts to minority and/or low-income populations based on CEQ guidance.

Section 3.11.1.1 reports the results of steps 1 and 2. Although no minority populations were identified, two low-income populations were identified (Census Tract 71 and the City of Old Town). The analysis then proceeded to step 3.

Step 3 requires assessing potentially high and adverse human health or environmental effects described in other resources sections in this chapter. Although some adverse impacts to resources were identified as a result of the proposed project, none were determined to be high and adverse human health or environmental effects. Because no high and adverse human health or environmental effects were identified, the analysis did not proceed to step 4. There would be no disproportionate impacts to minority or low-income populations from the proposed project.

3.11.2.2 Socioeconomics

The primary socioeconomic impacts resulting from the proposed project consist of an increase in demand for labor and non-labor inputs during construction and operations.

Project construction is expected to take 14 months. At its peak, employment would reach 80 construction contractor personnel. Because this is less than 1.6 percent of those estimated to be employed in construction in Penobscot County (see Section 3.11.1.2) and because the current unemployment rate in the county is 8.1 percent, construction personnel would be expected to be largely available locally. To the extent that construction materials are demanded from local or regional sources, this would also generate indirect job opportunities. Increases in demand for direct and indirect labor employed by the project would also induce further employment generation through the increased labor demand that follows the increased consumption of those employed. Because direct, indirect, and induced employment would be a small share of the local labor force of 78,334 and population of 153,923, and because labor is expected to be largely available locally to satisfy this increase in demand, any migration to the area in response to increased demand for labor would be expected to have no impact on local housing and infrastructure. The short-term increase in demand for labor would have a minor positive impact to the local economy.

During operations, 16 full-time employees would be hired for two 12-hour shifts. These employees would be expected to be available locally or regionally and would constitute a long-term minor positive impact to the local economy.

3.11.3 Environmental Consequences of the No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funding to OTFF, and OTFF would not build the biorefinery. There would be no impacts to low-income populations in the affected area under this alternative. The minor positive impact to the local economy from the biorefinery construction and operations would not occur.

3.12 Relationship Between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

CEQ regulations require consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). Biorefinery construction and operations would require short-term uses of land and other resources. *Short-term use of the environment*, as used here, is use that occurs during the life of the project, whereas *long-term productivity* refers to the period after project decommissioning, equipment removal, and land reclamation and stabilization. Short-term use of the project site for the proposed biorefinery would not affect the long-term productivity of the area. If OTFF decided that the project had reached its useful life, it could decommission and remove the equipment and new infrastructure and return the building to its original condition, the site could be used for another purpose at the pulp mill.

3.13 Irreversible and Irretrievable Commitments of Resources

The proposed project would not cause an additional irretrievable commitment of land because the biorefinery would be within the operating boundaries of an existing industrial facility. There would be an irreversible commitment of energy and construction materials to build the facility. Water resources used would be returned to the environment via water treatment facilities.

Implementation of the Proposed Action would require the commitment of financial resources by OTFF, its investors and lenders, and DOE for proposed project construction and operations. However, these commitments are consistent with the purpose of and need for the Proposed Action, as described in Chapter 2.

3.14 Unavoidable Adverse Impacts

Biorefinery construction and operations would cause unavoidable emissions of some criteria air pollutants, and use of electric power and natural gas. Water used from cooling would be discharged back into the Penobscot River under an existing MEPDES permit, with little evaporative loss. The need for construction materials such as steel and concrete would be unavoidable, but would represent a small fraction of available materials.

4. CUMULATIVE IMPACTS

4.1 Introduction

CEQ NEPA implementing regulations require the consideration of cumulative impacts as part of the process (40 CFR 1508.7):

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasona bly foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions, taking place over a period of time.

This section analyzes potential cumulative impacts to selected resource areas described throughout Chapter 3. The effects associated with the proposed project are analyzed in combination for their incremental contribution to cumulative effects when added to impacts from other planned and reasonably foreseeable actions. For an affected resource area, each reasonably foreseeable future action, including the Proposed Action, adds an increment to the total (cumulative) impact. For this analysis, the past and present effects are accounted for in the existing baseline of the affected environment section of this EA.

4.2 Existing and Reasonably Foreseeable Projects

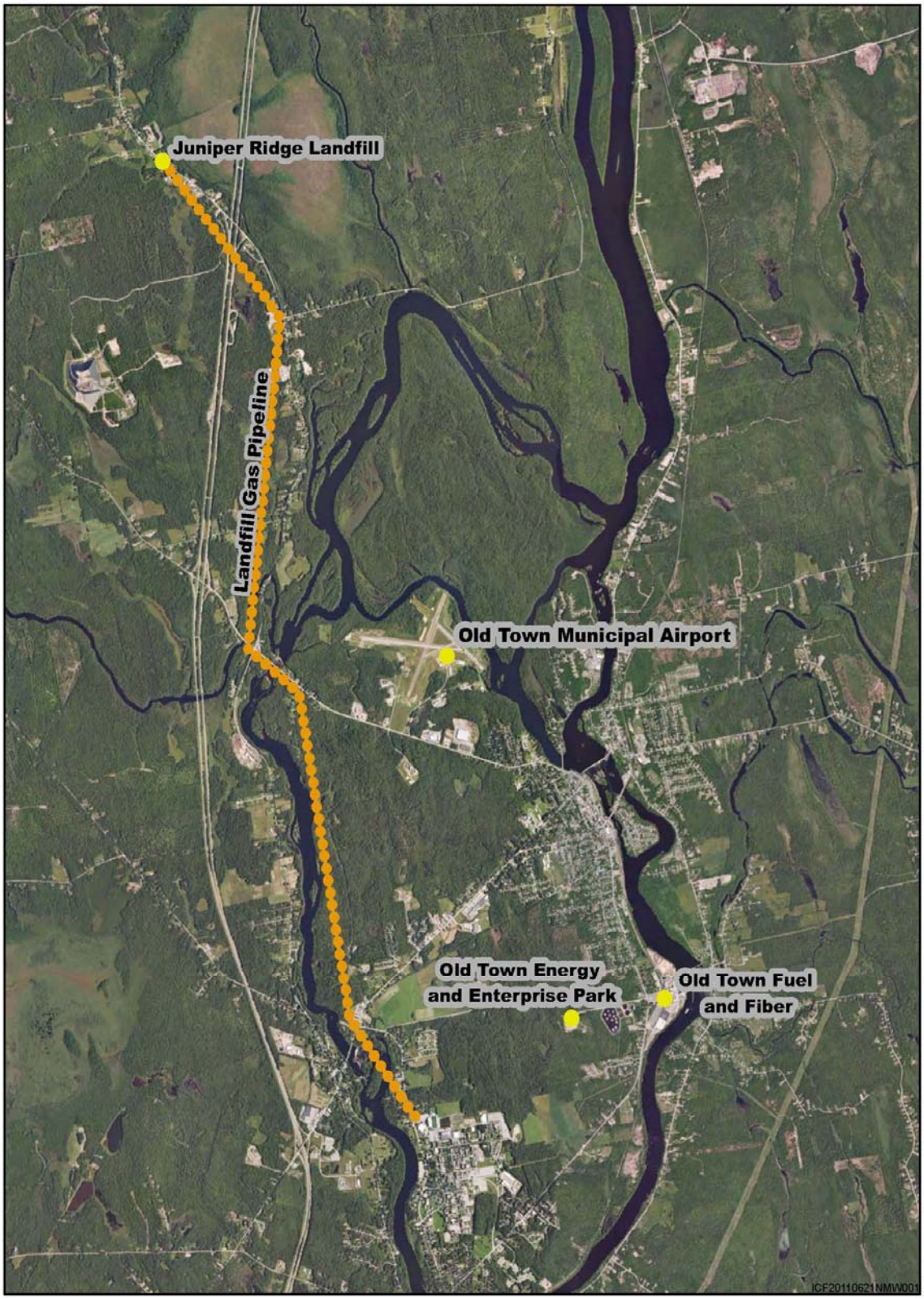
DOE reviewed information on past, present, and reasonably foreseeable future projects and actions that could result in impacts to a particular resource over the same period and in the same general location as the proposed project. DOE consulted with the City of Old Town planning departments via telephone and e-mail, and searched via the internet to identify current and future projects in to the vicinity of the proposed project.

In addition, DOE spoke with OTFF regarding future plans for the biorefinery and other projects at the pulp mill. Currently there are no firm commercialization plans for the proposed project; it would continue as a demonstration-scale project for the foreseeable future. OTFF anticipates that there could be interest from other mills in adopting their wood extract process. However, there are no firm plans for marketing at this time, nor has OTFF received any expressions of interest from other mills.

Projects identified as a result of this research are shown in Figure 4-1 and described below.

- **Pulp Mill -** The pulp mill has been operating since the mid 1960s. The pulp mill currently converts wood chips into pulp in the form of thick fiber boards using the Kraft pulping process. The pulp is then sold to paper manufacturers for further processing. Before use as the Kraft mill, the pulp mill had been operated as a chemical pulp mill since 1882. From the early 1970s until 2005, the mill site also operated a tissue mill. As part of the Penobscot River Restoration Project (see next project), the OTFF water supply intake will relocated downstream by the end of 2011.
- **Penobscot River Restoration Project -** The Penobscot River Restoration Project is a collaborative effort intended to restore native sea-run fish and their habitat while also providing the opportunity to maintain hydropower production. Major partners in the project include dam owner PPL Corporation; federal, state, and tribal governments; the Penobscot River Trust) and six conservation groups. Through this project, the Penobscot Trust has purchased three dams from PPL Corporation and will remove the two most seaward dams, Great Works and Veazie. The Penobscot Trust intends to construct a fish bypass around the third dam, Howland, allowing it to continue its hydropower generating function. PPL Corporation received the opportunity to increase generation at six existing

Figure 4-1. Existing and Reasonably Foreseeable Projects



dams, which will maintain all of its hydropower generation in the project area. PPL Corporation will also improve fish passage at four additional dams.

- **Old Town Energy and Enterprise Park** - The City of Old Town is in the early stages of planning the development of 120 acres of land for this industrial park off Penny Road. This site is zoned I-2 and is compatible with most industrial development. This park will incorporate the design of a limited-access parkway to the University of Maine via Penny Road. The new road access to and from the university would alleviate the traffic congestion on College Avenue and Stillwater Avenue, and would provide an alternative route for people living in Old Town, traveling to Interstate 95, or living in communities on the other side of Penobscot River.
- **Airport Improvements** - The City of Old Town prepared an update to the Airport Master Plan in 2002. This plan identified several items that need to be completed to enhance the general aviation industry at Dewitt Field Airport. Some projects have already been completed, including a new seaplane base access road. The city is currently applying for $625,334 from the Federal Aviation Administration and $16,482.50 from the State of Maine, and will match $16,482.50 for improvements to aircraft turnarounds to each runway. Once these initial projects are complete, the city will look at improvements to the existing facilities, new taxiways, a runway, two hangers, and apron and tie-down areas. Other improvements that will help promote use of the airport will be new fuel facilities.
- **Airport Business Park Development** - The City of Old Town has invested $100,000 in the development of land at the airport for economic development. The project is currently in the early stages of subdivision, local and MEDEP site location processes, and obtaining Federal Aviation Administration release of the land for lease in the Airport Business Park. The city will develop this property as a green, pristine business site that will be a location for technology-based businesses, aviation-related businesses, and other identified cluster businesses.
- **Juniper Landfill Gas Project** - A contract to build a gas pipeline from an Old Town landfill to the University of Maine to provide campus heating needs was signed on December 21, 2010. Several gas line routes are currently being considered, and a decision on which route to select has not been made; therefore, it is not shown on Figure 4-1. The pipeline is expected to be approximately 6 miles long**.**

4.3 Summary of Cumulative Impacts

4.3.1 Biological Resources

As a result of the Penobscot River Restoration Project dam removal, the Penobscot Trust has applied for and received authorization from the Corps of Engineers to move the pulp mill's water supply intake downstream because it currently lies behind Great Works Dam. The water supply intake move is expected to occur by the end of 2011 and OTFF would begin using it early in 2012. The dam removal is currently slated to occur in the summer of 2012. Although the dam removal, fish bypass construction, and the water supply intake move to downstream would result in temporary impacts to water quality and aquatic species due to presence of heavy equipment in the waterways, turbidity associated with construction, built-up sediment behind the dams, and noise, ultimately these projects will have a net benefit. These projects would implement all avoidance and minimization measures and best management practices in accordance with the permits and authorizations issued for them. While temporary impacts could be cumulatively significant, overall there would be a long-term cumulative net benefit. The June 30, 2011, NMFS letter of concurrence for the proposed project (see Appendix B) indicated that if the Veazie Dam, which is approximately 7 miles downstream of the proposed project, was removed, the NMFS would need to reassess potential effects to the endangered shortnose sturgeon and the candidate species Atlantic sturgeon. However, based on the Effluent Report prepared for the proposed project (ICF 2011), DOE determined that there would be no adverse impacts to listed or candidate species in the portion of Penobscot River adjacent to the proposed project with the addition of the biorefinery to the

existing wastewater treatment facility. The proposed project would not include any in-water activities, and changes in effluent discharge as a result of the addition of biorefinery operations would not be expected to result in adverse impacts to aquatic species. Therefore, the project would not contribute to a cumulatively significant impact nor would it contribute to the cumulatively significant benefit associated with the dam removal projects.

4.3.2 Traffic

The projects identified in Section 4.2 could increase traffic in the vicinity of the proposed project and the on surrounding highways. However, as a result of the Old Town Energy and Enterprise Park, a new access parkway to the University of Maine via Penny Road would be created. The new access road to and from the university would alleviate traffic congestion on College Avenue and Stillwater Avenue and would provide an alternative route for people living in Old Town, traveling to Interstate 95, or living in communities on the other side of Penobscot River. As shown in Section 3.10, the various roads used by traffic that would be associated with the proposed project have sufficient capacity to handle increased traffic as a result of the project. Depending on the future tenants of the Old Town Energy and Enterprise Park, additional traffic volume on Penny Road and other local roads could result in the need for additional road improvements. Future traffic studies would be needed to determine if future improvements are necessary to accommodate further development of the Old Town Energy and Enterprise Park when project details become available.

4.3.3 Socioeconomics

The proposed project would have a positive impact on the local economy through the creation of jobs and spending in the area. This positive impact would further enhance the net benefits related to the projects identified in Section 4.2. Local resources such as schools, hospitals, parks, and public safety agencies could also expect an increase in activity due to the population increase. However, these resources would be supported by accompanying increases in the local tax digest due to the same growth factors.

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