NORDIC EXHIBIT 8

Natural Resources Report
Nordic Aquafarms Aquaculture Facility
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Belfast, Maine

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1.0 Introduction

Nordic Aquafarms proposes the construction and operation of a Land based salmon farm in Belfast, Maine. If approved, construction is planned for 2019.

The proposed site sits just south of the city of Belfast, at the mouth of the Little River. The land based portion of the project which will include the majority of the construction, will occupy land which lies on the north shore of the water body called, “Belfast Reservoir Number One”. This reservoir is a ponded section between two dams on the Little River. This land is owned by the Belfast Water District. In addition to this parcel of land, some adjacent parcels will be used for the development of this aquaculture facility. Some in-water construction will also be required, which will occur in Belfast Bay, which is generally described as a shallow, (less than 70m deep) muddy portion of greater Penobscot Bay.

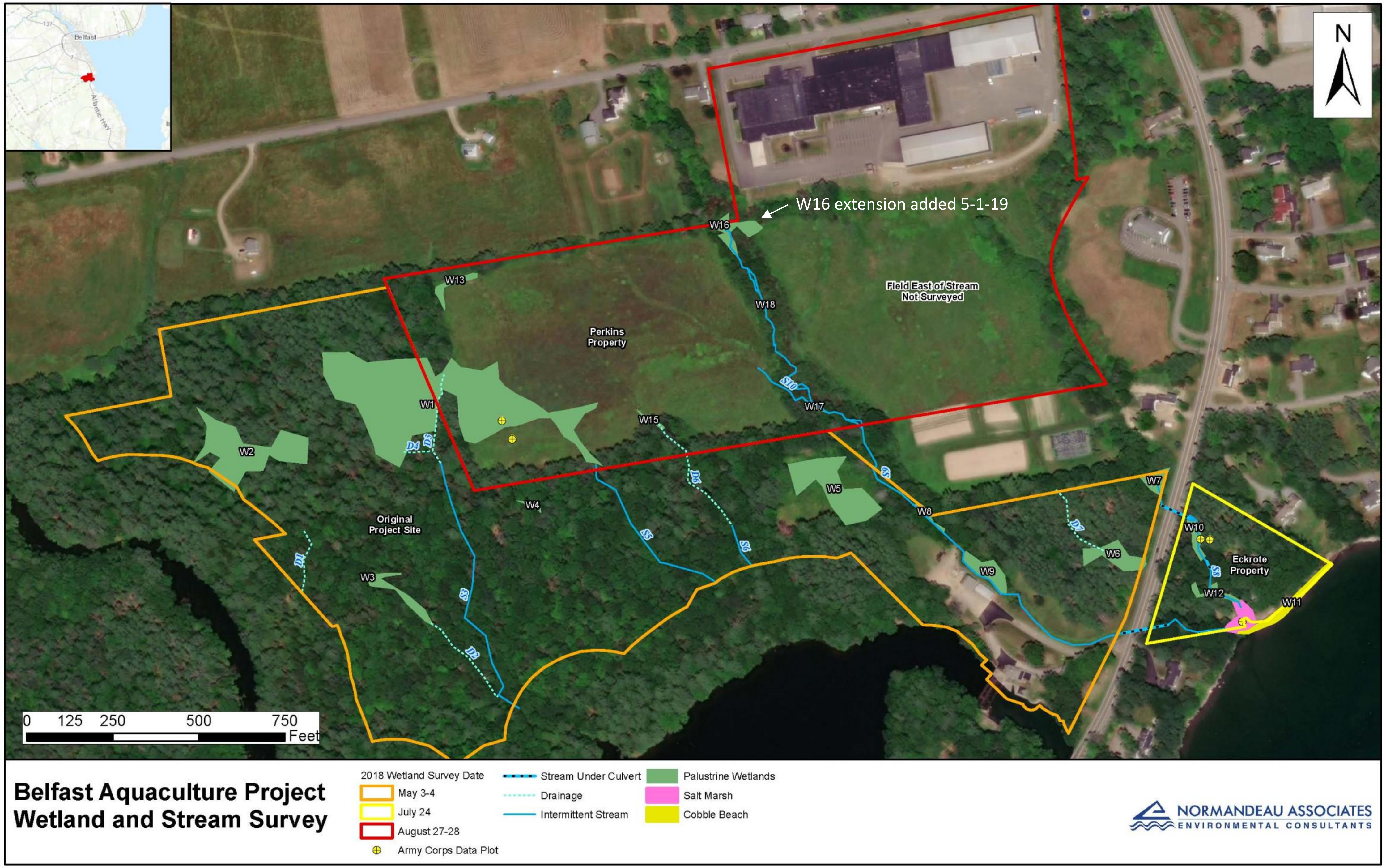
2.0 Wetlands and Vernal Pools

2.1 Wetlands, Vernal Pools Methods

Normandeau Associates, Inc. (Normandeau) performed wetland and stream delineations, as well as vernal pool surveys in the project area. The project site consists of approximately 54 acres. The survey area did not include approximately 250-feet from the edge of water in the impoundment, as project construction is outside of this zone. See Figure 1 for the project site boundary.

Review of wetlands on site were conducted on May 3 and 4, July 24, and August 27 and 28, 2018 and May 1, 2019. Review of vernal pools also took place during the survey on May 3 and 4 with a return visit on May 18, 2018. Survey dates of each parcel can be found on Figure 1.

Wetland boundaries were delineated according to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0), which utilizes the three parameter approach (i.e., evaluating the site for the presence of hydric soils, hydrophytic vegetation and wetland hydrology) for identifying wetlands and determining their jurisdictional limits. Wetland boundaries were surveyed at the time of delineation using a Trimble® Global Positioning System (GPS) unit capable of sub-meter accuracy and post-processed against known base stations. These GPS points were translated into a detailed map depicting jurisdictional boundaries using Normandeau’s geographic information system (GIS) software.


N
W16 extension added 5-1-19
W16
W13
W18
Field East of Stream Not Surveyed
Perkins Property
W1
W15
W17
W2
W5
W7
W8
W4
Original Project Site
W10
Eckrote Property
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W9
W3
W12
W11
0 125 250 500 750
Feet
Belfast Aquaculture Project
Wetland and Stream Survey
2018 Wetland Survey Date
May 3-4
July 24
August 27-28
Army Corps Data Plot
Stream Under Culvert
Drainage
Intermittent Stream
Palustrine Wetlands
Salt Marsh
Cobble Beach
NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Figure 1.

Vernal pool surveys were performed using Maine Department of Inland Fisheries and Wildlife (IF&W) guidelines which call for a ground survey of all potentially impacted areas and adjacent lands. Any potential pools are visited a minimum of two times during the vernal pool survey window, which occurred from approximately mid-April to early May 2018. Each potential pool was examined thoroughly for the presence of vernal pool indicator species, including wood frog (*Lithobates sylvaticus*), spotted salamander (*Abystoma maculatum*), and blue-spotted salamander (*Abystoma laterale*) egg masses, or the presence of fairy shrimp in any life stage.

Army Corps of Engineers Wetland Delineation Data sheets (Appendix A) were completed for representative wetland types along with physical stream characteristics and a functions and values assessment for all wetlands using the Army Corps of Engineers Highway Methodology[1]. The wetlands were also classified by cover type according to the classification system developed by Cowardin et al.[2] and representative photos are included in Appendix B.

2.2 Wetlands, Vernal Pools Results

2.2.1 Palustrine Wetlands

A total of 17 wetlands were identified on site (Table 1). Of these, nine wetlands meet the criteria for freshwater wetlands of special significance (WOSS) under the Natural Resources Protection Act (NRPA): W7, W8, W9, W10, W11, W12, W16, W17, and W18. Areas of these wetlands within 25-feet of the banks of their associated streams carry a higher regulatory burden under NRPA. Additionally, wetlands W10, and W12 are located within 250 feet of a coastal wetland. The remaining eight wetlands do not meet such criteria. Table 1 contains a summary of a functional assessment of identified wetlands.

Wetlands W1, W2, and W3 are forested wetlands dominated by a mixture of deciduous and coniferous species, including red maple (*Acer rubrum*), white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), and red spruce (*Picea rubens*). Species such as the pine, spruce, and hemlock are not typically regarded as wetland species, however it is acknowledged that these species are known to be found in wetlands in the northeastern region. This site is largely composed of fine textured soils that restrict the infiltration of water, and creating wetland environments. This is exemplified by the roots of the white pine, red spruce, and hemlock in wetlands W1 and W2, which are at or near the surface of the soil. This limited rooting depth in response to a high water table is known as a morphological adaptation of upland plants to wetland soil, and is sufficient to meet wetland vegetation criteria for the purpose of wetland delineations. Additionally, the understory in these wetlands consisted of wetland species such as cinnamon fern (*Osmundastrum cinnamomeum*) and sensitive fern (*Onoclea sensibilis*). A large amount of the non-native invasive shrub glossy false buckthorn (*Frangula alnus*) was present throughout W1, limiting the value of this wetland. Wetland W1 also extends into the adjacent hayfield on the Perkins Avenue parcel. This portion of the wetland is dominated by bluejoint (*Calamagrostis canadensis*) with numerous other common weedy field species present, including red clover (*Trifolium pretense*) and cow vetch (*Viccia cracca*).

[1] The Highway Methodology Workbook, Supplement, NAEEP-360-1-30a, September 1999

[2] Cowardin, L.M., V. Carter, F.C. Golet, E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service: Washington, D.C.

Wetland W4 is an isolated depression in an oak dominated forest. There is evidence of standing water, and the understory is generally sparse and dominated by various sedges (*Carex* spp.) that were unidentifiable to species due to the early season survey. This wetland is marginal and possesses no discernible surface water outlet.

Wetland W5 is a portion of an old field. The water table in this area is at or near the surface, likely due to repeated disturbance and compaction associated with maintaining the field. The wetland is dominated by meadowsweet (*Spiraea alba* var. *latifolia*), with various herbs such as common wrinkle-leaved goldenrod (*Solidago rugosa* ssp. *rugosa*), sensitive fern, and common grass-leaved-goldenrod (*Euthamia graminifolia*) intermixed.

Wetlands W6, W7, W8, and W9 are all associated with watercourses. These wetlands receive additional flow during periods of seasonal high water, and likely during major storm events as well. W8 and W9 are along the same stream, and are of similar character. The understory is dominated by herbs such as American trout-lily (*Erythronium americanum*) and cinnamon fern. The overstory of these wetlands often contains black ash (*Fraxinus nigra*), a frequent floodplain species, as well as green ash (*Fraxinus pennsylvanica*), black cherry (*Prunus serotina*), speckled alder (*Alnus incana* ssp. *rugosa*), and red maple. Wetland W7 is the most highly degraded by disturbance due to proximity to the road and a nearby residence, whereas W9 is generally undisturbed. Wetlands W7, W8, and W9 are considered WOSS under NRPA.

Wetlands W13 and W15 (W14 = W1) are small wet meadow (PEM1) depressions with vegetative character similar to the emergent portion of W1. These wetlands are relatively limited in function on account of their short hydroperiod and low diversity of wetland plants.

Wetlands 16, 17, and 18 are narrow fringes to stream S9, collectively occupying less than one tenth of an acre. These wetlands are classified as palustrine scrub-shrub (PSS1) wetlands, and are dominated by speckled alder (*Alnus incana*) in the shrub layer and spotted touch-me-not (*Impatiens capensis*) in the herb layer. These wetlands provide some flood storage and shoreline stabilization on account of their proximity to the intermittent stream. Their location along the stream results in their classification as WOSS under NRPA.

Wetlands W10 and W12 are palustrine forested wetlands separated by a driveway, but hydrologically connected by an intermittent stream. These wetlands are similar in character, and lie on a narrow terrace at the bottom of a deeply incised ravine. Given their small size, these wetlands contain a relatively low diversity of plants, but are dominated by black elderberry (*Sambucus canadensis*), green ash (*Fraxinus pennsylvanica*), and speckled alder (*Alnus incana*) with an understory of sensitive fern (*Onoclea sensibilis*), spotted touch-me-not (*Impatiens capensis*), and cinnamon fern (*Osmunda cinnamomea*). These wetlands are moderately disturbed on account of the adjacent road and driveway. Due to their proximity to the coastal wetlands (within 250 ft) and association with an intermittent stream, they are WOSS under NRPA.

2.2.2 Estuarine/Marine Wetlands

Wetland W11 represents the salt marsh on the Eckrote property. The salt marsh area is relatively small and limited to the mouth of the stream (S8). It is dominated primarily by black rush (*Juncus gerardi*) at higher elevations and smooth cordgrass (*Spartina alterniflora*) at lower elevations. The adjacent beach is dominated by cobble substrate with little to no vegetation.

A MDEP Coastal Wetland Characterization: Intertidal & Shallow Subtidal Field Survey Checklist was completed for this project on March 26, 2019 (Appendix C).

Table 1. Summary of Palustrine and Estuarine Wetlands Identified on Site

Wetland ID	Cowardin Class	Groundwater Recharge/Discharge	Floodflow Alteration	Fish/Shellfish Habitat	Sediment/Toxicant Retention	Nutrient Removal	Sediment/Shoreline Stabilization	Production Export	Wildlife Habitat	Recreation	Educate/Scientific Value	Uniqueness/Heritage	Visual Quality/Aesthetics	Endangered/Threatened Species Habitat	Wetland Description
W1	PFO	X	P	-	-	-	X	X	X	-	-	-	-	-	Coniferous overstory, highly invaded by buckthorn
W2	PFO	X	X	-	-	-	-	-	X	-	-	-	-	-	Deciduous dominated, drains off-site
W3	PFO	-	-	-	-	-	-	X	-	-	-	-	-	-	Small, marginal swale, drains into ephemeral gully off survey area
W4	PFO	X	-	-	-	-	-	-	-	-	-	-	-	-	Isolated pocket, area of standing water
W5	PSS	X	P	-	-	-	-	X	P	-	-	-	X	-	Old field, disturbed but high plant diversity, good shrub habitat for wildlife
W6	PFO	-	P	-	X	-	X	P	X	-	-	-	-	-	Stream S7 braids through this area, wetland is broad and saturated prior to roadway
*W7	PFO	-	X	-	X	X	X	P	X	-	-	-	-	-	Wetland area around stream S8
*W8	PFO	-	X	-	-	-	P	X	-	-	-	-	X	-	Floodplain wetland associated with stream S9
*W9	PFO	-	X	-	-	-	P	X	-	-	-	-	-	-	Small floodplain wetland
*W10	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow fringe on stream S8, surrounded by development
*W11	E2EM/ M2US	-	-	X	-	-	P	-	X	-	-	-	X	-	Saltmarsh and cobble beach at mouth of stream S8
*W12	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow fringe on stream S8, surrounded by development
W13	PEM	X	-	-	-	-	-	-	-	-	-	-	-	-	Small emergent wetland along edge of field
W15	PEM	X	-	-	-	-	-	-	-	-	-	-	-	-	Small wet meadow
*W16	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Floodplain along stream S9
*W17	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow wetland fringe along stream S9
*W18	PSS	X	X	-	-	-	X	-	-	-	-	-	-	-	Narrow wetland fringe along stream S9

*= WOSS, Functional Assessment Qualitative Assessment Categories: P=Principal Function/Value; X=Suitable Function/Value.
Cowardin Class: PSS = Palustrine (freshwater) Scrub-Shrub; PFO = Palustrine Forested

2.2.3 Vernal Pools

An initial vernal pool survey conducted on May 3 located areas of standing water in wetland W1 and W3 that appeared suitable for vernal pool obligate species, although none were observed during this visit. Upon the return visit to the site on May 18, these areas remained saturated, however the water table had dropped below the soil surface and therefore did not provide for any suitable habitat for amphibian breeding areas. This site does not appear to possess surface water for a sufficient time in the appropriate season to support viable vernal pool habitat. Vernal pool surveys were not conducted on the sites reviewed on July 24 and August 27 and 28; however, no potential vernal pools were identified during those surveys.

2.3 Streams and Drainages Methods

Review of drainages on site were conducted on May 3 and 4, July 24, and August 27 and 28, 2018 and February 28, 2019 to observe flows to aid in the determination of NRPA jurisdiction. Drainages were evaluated based on the criteria identified in the "*NRPA Identification Guide for Rivers, Streams and Brooks"* to determine jurisdiction. A jurisdictional river, stream or brook has a defined channel and 2 or more of the following characteristics

A. It is depicted as a solid or broken blue line on the most recent edition of the U.S. Geological Survey 7.5-minute series topographic map or, if that is not available, a 15-minute series topographic map;

B. It contains or is known to contain flowing water continuously for a period of at least 6 months of the year in most years;

C. The channel bed is primarily composed of mineral material such as sand and gravel, parent material or bedrock that has been deposited or scoured by water;

D. The channel contains aquatic animals such as fish, aquatic insects or mollusks in the water or, if no surface water is present, within the stream bed;

E. The channel contains aquatic vegetation and is essentially devoid of upland vegetation.

Streams were classified according to the highway methodology (see footnote 1).

2.4 Streams and Drainages Results

Based on NRPA criteria, drainage features D1, D2, D3, D4, D6, and D7 are not jurisdictional as they do not have a defined bed and bank. These drainages are the result of stormwater runoff that result in short periods of flow and do not meet the criteria to be jurisdictional. These drainages are typically characterized by no channelization, organic matter in the streambed, and often little or no flowing water during a time of the year when flows are at or near their seasonal peak. Features S3, S6, S8, and S9 have been determined to be jurisdictional streams as they exhibit channelized banks and at least two of the required criteria.

Site observations did not provide sufficient information to make a jurisdictional determination for drainage features S5 and S10 (Table 2). In January and February S5 had ice in the channel bed, but it is unclear whether there is continuous flow for six months. S10 did not contain water during August, and appears to lack sufficient depth to maintain flow for six continuous months. These two features will require further flow observations and aquatic surveys in the appropriate season to verify jurisdiction. Until their NRPA status is clearly determined, we have assumed that S5 and S10 are NRPA jurisdictional streams and are included in reported impact numbers.

Jurisdictional streams within the study area commonly provide functions that include groundwater discharge. The intermittent streams on site are also suitable habitat for wetland-associated wildlife species including stream-breeding salamanders and aquatic invertebrates. See Table 3 for a brief summary of features assessed for stream function on the project site.

Table 2. NRPA criteria for drainages within the project area

Stream/Drainage ID	Defined Bed and Bank	Blue Line on USGS Map	Continuous flow for at least 6 months*	Channel bed composed of mineral material	Aquatic Animals	Aquatic Vegetation	NRPA Jurisdiction
D1	N	N/A					No
D2	N	N/A					No
D3	N	N/A					No
S3	Y	N	Y (May, Jul, Aug, Dec, Jan, Feb)	Y	N/A	N	Yes
D4	N	N/A					No
S5	Y	N	? (Dec, Jan, Feb)	Y	?	N	Maybe
D6	N	N/A					No
S6	Y	N	Y (May, Jul, Aug, Dec, Jan, Feb)	Y	N/A	N	Yes
D7	N	N/A					No
S8	Y	N	Y (May, Jul, Aug, Dec, Jan, Feb)	Y	N/A	N	Yes
S9	Y	Y	Y (May, July, Aug)	Y	N/A	N	Yes
S10	Y	N	? (Aug, Feb)	Y	?	N	Maybe

3.0 Wildlife

3.1 Wildlife Methods

The proposed Nordic Aquaculture project site was evaluated for wildlife and habitat resources via a desktop review of existing information, including reviewing aerial photography (Google Earth), a timber inventory conducted on-site in 2019, e-Bird data, and other publically available data regarding species distribution from the Maine Department of Inland Fisheries and Wildlife (MDIFW) and Maine Natural Areas Program (MNAP) – See Appendix D, and a field visit. The field visit was conducted on the upland parcels on December 12, 2018, and evaluated general wildlife habitat value and potential listed-species habitat. The visit was conducted midday under good weather conditions that included ideal snow cover conditions for tracking.

Table 3. Summary of Functions for Jurisdictional Drainage Features Identified on Site

FeatureID	Flow Regime	Flow Observations	Dominant Bed Composition	Average Width (feet)	Average Depth (inches)	Functions
S3	Intermittent	Low	Sand, silt, organic	4	2	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S5	Intermittent	Low	Silt/clay	4	2	Floodflow alteration
S6	Ephemeral grading to Intermittent	Low	Silt, cobbles	3	2	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S8	Intermittent	Moderate	Silt/clay	5	4	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S9	Intermittent	Moderate	Silt/clay, cobbles	7	6	Groundwater Recharge/Discharge, Floodflow Alteration, Wildlife Habitat
S10	Intermittent	Dry	Silt/Clay	2	1	Floodflow Alteration

In addition to the terrestrial habitats impacted by the project, the desktop evaluation also considered the intertidal portion of Belfast Bay which will be impacted by the intake and outfall pipes. This area is included in the wildlife evaluations because it is designated as Tidal Waterfowl and Wading Bird Habitat (TWWH). Belfast Reservoir Number One, adjacent to the project site, was also considered because it is designated ad Inland Waterfowl / Wading Bird Habitat (IWWH). Both TWWH and IWWH are regulated Significant Wildlife Habitat under Maine's Natural Resources Protection Act. The desktop sources cited above as well as information collected during the benthic studies conducted for the project were considered for this portion of the evaluation.

3.2 Wildlife Results

3.2.1 Habitat Available

As indicated by review of aerial photography, the proposed project site is similar to the surrounding landscape in natural land cover and amount of human development and activity. Due to high proportion of natural and semi-natural cover types and small amount of developed area, the site is expected to provide good general wildlife habitat for most if not all of the common wildlife species that use the habitats that are present on-site.

3.2.1.1 Terrestrial Habitats

As detailed in the 2019 Timber Inventory by CLT, Inc. (Appendix E), and confirmed during the on-site habitat review, the project site is primarily forestland that gradually slopes southward towards Belfast Reservoir Number One. These forest stands are either hardwood (±19 acres) or pine (±15 acres) dominated. Stand age and condition, and remnant barb wire fence on site suggests that areas of the forested property were previously cleared for farm fields or pasture. Portions of the forested stands appear to have been recently selectively harvested. In the hardwood stand, the cover is dominated by red oak with lesser amounts of red maple, bigtooth aspen, and eastern white pine, as well as small components of six other species (paper birch, sugar maple, eastern hemlock, red spruce, yellow birch, balsam fir). The pine stands are dominated by eastern white pine with lesser amounts of paper birch, balsam fir, red maple, and bigtooth aspen, and a small component of American beech and northern white cedar. The variety of hard and softwood species provides multiple sources of food for wildlife, including acorns, other seeds, and browse, as well as shelter. Some smaller snags are present and a few larger trees have hollows, but due to the age of the stand as secondary growth, these features are not abundant.

The field habitat on-site appears to be regularly mowed for hay, which reduces its value for wildlife habitat. However, regularly mowed hayfields do provide habitat for snakes and frogs in summer, and for certain small mammal and bird species year round. The species of bird most likely to use hayfields varies with the season and the height of the vegetation.

3.2.1.2 Wetland Habitats

As detailed in Section 2, Wetlands, the project site supports some wetland habitats, including intermittent streams. Due to the soils present on-site, these wetland and stream habitats have a minimal hydroperiod, limiting their value to wetland-dependent wildlife species that require more constant levels of inundation. However, the intermittent streams on-site do provided some suitable habitat for wetland-associated wildlife species adapted to a limited hydroperiod, including certain stream-breeding salamanders, discussed below, and aquatic invertebrates.

3.2.1.3 Tidal Waterfowl and Wading Bird Habitat

The TWWH area that will be impacted by the intake and outfall pipes is part of a substantially larger intertidal area that extends roughly from the mouth of the Little River southwards for about ¾ of a mile to Browns Head, a Point on the Northport, ME shoreline. This entire area is designated as TWWH, which is a class of habitats recognized as a Significant Wildlife Habitat under Maine’s Natural Resources Protection Act, which is discussed more fully in Section 3.2.3.

3.2.1.4 Inland Waterfowl / Wading Bird Habitat

The MNAP mapping which designates Reservoir One as IWWH includes the reservoir itself, as well as the shores. The entire reservoir and adjacent shores is designated as IWWH from the lower dam inland. IWWH is a class of habitats recognized as Significant Wildlife Habitat under Maine’s Natural Resources Protection Act, which is discussed more fully in Section 3.2.3.

3.2.2 General Wildlife

As noted above, the habitat present in the project site is suitable for a wide variety of species that occur in this region of Maine.

Reptiles and Amphibians – Seasonal conditions during the site visit were not suitable for observing reptiles or amphibians. However, the species potentially present can be estimated based on known distributions and the type of habitat available within the project site. Turtles are not expected to use the site due to the lack of wetland habitats, and turtles that may use the adjacent reservoir are unlikely to use the site as nesting habitat due to its generally wooded, shaded conditions and soil type (see Soil Map, Appendix F). Likewise, shaded forest habitats are less preferred by the snake species with a known range that coincide with the project site, except for the common garter snake, which is expected to be present throughout the site. Milk, ringneck and northern red-bellied snakes may also be present, but would most likely be restricted to forest edges and the field habitats. Because there are no open water wetlands or vernal pools present on the parcel, the amphibian species likely to be present are the northern red-back salamander, a forest-dwelling species which does not require water to breed, and those species adapted to a limited hydroperiod and/or which may have suitable breeding habitat in adjacent areas and that are capable of traveling widely during the non-breeding season, including eastern newt, northern two-lined salamander, and American toad.

Birds - A project-specific avian survey was not conducted. However, bird records from the Little River Hiking Trail (LRT), located immediately south of the site have been submitted to e-Bird (https://ebird.org/hotspot/L4691557) since 2016, and records from the Perkins Road fields (PRF), just to the north of the site, have been submitted since 2013 (https://ebird.org/hotspot/L1440286). The habitat surrounding the LRT is essentially the same as the forest habitat on-site, and the on-site field habitat is contagious to hayfields on Perkins Road. Therefore, the records from these two locations provide a good indication of the species likely to be present at the project site, and are listed in Appendix G. Species from the LRT that are strictly associated with water (the reservoir) are not included in this list. Also note that species that prefer larger fields (e.g., bobolink, savannah sparrow), or that are commonly associated with buildings/human activity (e.g., European starling, house sparrow) are less likely to be present on-site, as the field is smaller than the adjacent hayfield, and has no houses/buildings.

Based on e-bird reports, the species expected to use the TWWH within the project area include all of the common sea duck and shorebird bird species that occur in the this region of Maine. Shorebirds commonly use the Maine shoreline as stopover and feeding habitat during migration, especially during mid- and late summer, while sea ducks primarily use it as overwintering habitat, roughly from late October to April or early May. Species that have been reported to e-bird from Belfast are listed in Appendix G, the sea duck species listed are specifically reported from the mouth of the Little River while the shorebirds are from the greater Belfast Bay area.

Mammals – Conditions during the site visit were ideal for tracking, and track and sign of eight mammals species were observed in the forested portion of the site, including white-tailed deer, red fox, coyote, fisher, grey squirrel, red squirrel, deer mouse, and porcupine. Based on the timing of the last snowfall, most tracks were less than 24 hours old. Deer, red squirrel, and porcupine sign was common, but not abundant, scattered throughout the parcel, and included scat as well as tracks, sign of feeding, and an actively-used porcupine den located under the overhang of S3. Tracks for the predator species were less abundant, but relatively wide ranging across the parcel. Deer may feed in the field portion of the site, especially in spring and mice, voles and shrews likely use this habitat year-round, and coyote and fox in turn hunt for these small mammals in the field on occasion, throughout the year.

In addition to the species with sign observed on-site, a variety of other mammals that are common in this region of Maine potentially use the habitats on-site, and these species are also listed Appendix G.

3.2.3 Special Status Species and Significant Wildlife Habitat

For the purposes of this discussion, special status species include those listed by the State of Maine as Species of Special Concern (SC), threatened (ST), or endangered (SE), as well as species federally listed as threatened or endangered (FT, FE).

Invertebrates – Based on known distribution and habitat preferences of Maine's special status invertebrate species, none of these species are expected to be present within the project site.

Reptiles and Amphibians - Based on known distribution and habitat preferences of Maine's special status reptile and amphibian species, none of these species are expected to use habitats within the project site.

Birds – Of the 56 terrestrial species that likely use the on-site habitats, based on their habitat preferences and e-bird records, eight are listed as SC, and five designated as Species of Greatest Conservation Need (SGCN) in *Maine's Wildlife Action Plan* (2015)[3]. None are listed as State or federally threatened or endangered. Eleven of these 13 special status species are long-distance migrants that spend the winters in Central or South America and their summers in northern latitudes. The wood warblers (American redstart, northern parula, black and white, chestnut-sided, black-throated green, and black-throated blue warblers) depend on upland forest habitats for feeding and breeding, as does the eastern wood-pewee, while the veery uses understory thickets associated with water courses and surrounding uplands, and bobolinks and barn swallows use open fields. The two short-distance migrants, the purple finch and white-throated sparrow, use a variety of edge and wooded habitats. All 13 species are likely to use the site during migration, and have at least some potential to nest on-site.

Of the 19 water bird species with a high likelihood of using the TWWH associated with the intake and outfall pipes, based on e-bird records, three are listed as SC (greater scaup, lesser yellowlegs, semipalmated plover), and four additional species are designated as SGCNs (common eider, least sandpiper, long-tailed duck, semipalmated sandpiper). None are listed as State or federally threatened or endangered.

Mammals – All of Maine's eight bat species are listed, and based on known distribution and the habitat available, all have some potential to be present during the summer. The forest cover on-site provides ample summer roosting habitat for the foliage-roosting species (eastern red, hoary, and silver-haired bat, all listed as SC) as well as the northern long-eared bat (SE, FT), which roosts under loose bark and tree trunk crevices and hollows. Structures on-site and nearby provide potential summer roosting habitat for little brown bats (SE) and big brown bats (SC), and forest edges and the nearby reservoir provide suitable feeding areas for all these species as well as the eastern small-footed bat (ST). No other listed mammals are expected to be present.

Tidal Waterfowl and Wading Bird Habitat – Designated TWWH will be temporarily impacted during the preconstruction assessment of the area to be trenched and the installation of the intake and

[3] Maine Dept. of Inland Fisheries and Wildlife. 2015. Maine's wildlife action plan. Maine Dept. of Inland Fisheries and Wildlife, Augusta, ME.

outfall pipes. This impact area is located in larger intertidal area that extends roughly from the mouth of the Little River southwards for about ¾ of a mile to Browns Head, a Point on the Northport, ME shoreline, covering over 4 million square feet. The value of TWWH is associated with feeding habitat that it provides for waterfowl and wading bird species, generally intertidal mudflats, eelgrass and mussel beds where they can forage for aquatic invertebrates. The intertidal area that will be impacted by the project has a cobbley and firm substrate and does not support any mussels, eelgrass, or shellfish beds.

Inland Waterfowl / Wading Bird Habitat - Forest cover is generally present right up to the shoreline, which is also relatively steep, and there is no shoreline emergent vegetation to provide cover. All these attributes make the shore low value habitat for inland waterfowl and wading birds. The reservoir itself does provide some opportunity for these species to loaf or feed, especially ducks, which e-bird records indicate are observed on the reservoir in moderate numbers during migration, especially in the spring. The project does not propose any changes to Reservoir One or the adjacent shoreline.

4.0 Fisheries

4.1 Fisheries Methods

The Nordic Aquaculture project site was evaluated for fisheries habitat resources via a desktop review of existing information, as well as field surveys conducted by Normandeau Associates in 2018. In addition to a literature review, a habitat characterization survey was conducted by towing a diver and a camera along the proposed pipeline route. Also, water quality data were collected to assess the existing ambient conditions at various locations where in-water structures are proposed. MDIFW and the Maine Department of Marine Resources (MDMR) were both consulted for guidance on species of interest as well as suggestions regarding potential impact mitigation strategies.

During analysis, the specific engineering characteristics, and construction plan of the proposed project were used to help determine the potential impact to each species. Impacts were characterized as temporary if they would only exist due to construction activities, or permanent if the impact would continue after construction was finished and facility operation continued.

4.2 Fisheries Results

4.2.1 Habitat Available

There are two fisheries habitat types associated with the project site, freshwater and marine. These habitat types are discussed individually in sections 4.2.2 and 4.2.3 below.

4.2.2 Freshwater Habitat

The potential freshwater habitat on or adjacent to the site consists of one reservoir and intermittent streams. The streams are mainly avenues for water to drain from upland areas during significant rain events. They do not stay watered for enough of the year to present a significant potential habitat for fisheries.

The reservoir, “Belfast Reservoir Number One” is a ponded section between two dams on the Little River. This habitat does provide adequate habitat for some freshwater species, however there were no specific reservoir species recommended for impact assessment by the state. In order to prevent impact to this water body, erosion and sedimentation control measures will be implemented during Project construction, as outlined in Section 14, and permanent vegetative buffers will be maintained between the reservoir and the Site, as detailed in Section 10. Vegetative buffers will include a 250-foot shoreland zone, measured from the mean high water mark, on the project site of the reservoir with the exception of the areas where the water district office building is currently located. This shoreland buffer is located outside of the Site boundary, but ownership will be passed from the Belfast Water District to the City of Belfast for preservation as conservation land.

Surface water withdrawal from Belfast Reservoir Number One, through an existing intake infrastructure located at the dam, is proposed to meet project freshwater needs. The withdrawal will comply with Chapter 587: In stream flows and lake and pond water levels. The reservoir is positioned uniquely, as discharge from this water body flows directly into a tidal inlet of Belfast Bay. MEDEP Chapter 587 allow a maximum withdrawal of up to 1.0 acre-feet of water per acre of the reservoir at normal high water between April 1 and July 31, and up to 2.0 acre-feet of water per acre of the waterbody at normal high water from August 1 to March 31 during any given year. The Chapter 587 rules also allow for any surplus water demonstrated to have been delivered to the reservoir beyond the maximum acre-foot withdrawals to be included in the overall withdrawal, with the limitation that volume not be decreased beyond 25%, or the lowest level attained by the grade of the dam. If any work should be required for this project within waters considered to be inland fisheries habitat, an in-water work window of July 15th to October 1st would be observed, as requested by MDIFW. At this time, no freshwater work is expected.

4.2.3 Marine Habitat

Other than the first short distance from shore, the marine portion of the proposed path of the intake and discharge pipes contains habitat that is quite homogenous. Upon review of the video recorded by Normandeau Associates in August 2018, the predominant habitat within the subtidal area is fine grain sandy, silty, muddy substrate mixed in with relatively small cobble, and almost no vegetation. Additionally, circular depressions in the seafloor are quite abundant in the bay. These depressions are referred to as “Pockmarks”, they are an unusual geological feature that occurs worldwide as described in Fandel 2013[4]. These pockmarks are formed primarily by the historic escape of methane gas through the estuarine sediment, which displaces the substrate thereby forming the pockmarks. Pockmark size ranges from 1 m to greater than 1 kilometer in diameter. These pockmarks will be avoided in the path of the pipes due to the added difficulty of installing pipe across these features. Under the proposed design, the terminus of the pipes will be located closer to shore than any of the major pockmarks that occur in the bay. The pockmarks are shown in the bathymetric survey completed by Normandeau in 2018 and is included in Appendix H.

In the closest section to shore, in the subtidal area, there are some small patches of vegetation that could be used as viable habitat for a variety of finfish or shellfish species. Vegetation consisted of common intertidal and shallow subtidal species. Two Fucaceae species: Bladderwrack (*Fucus vesiculosus*) and *Ascophyllum nodosum*, were observed, as well one rhodophyte species identified to be Irish Moss (*Chondrus crispus*). Also present are smaller amounts of some larger diameter substrates including cobble, boulders, and shells. These small patches of vegetation did not represent a substantial portion of the proposed construction area.

[4] Fandel, C. L. 2013. Observations of Pockmark Flow Structure in Belfast Bay, Maine. Thesis. Submitted to the University of New Hampshire

Fishes, crabs, sea stars, and shellfish were not very prevalent in the video, but it is likely some of the mobile organisms detected the towed camera and boat, moving from the visual field. This indicates that the majority of the seafloor life is likely to temporarily relocate on its own and presumably re-colonize the area post-construction. Mobile organisms will likely recolonize the area post-construction. Sessile organisms will begin recolonization after the first spawning season post-construction. Wilber and Clarke (2007)[5] found that recovery time in dredged channels generally ranged from one to six months although in some cases it was more than one year. Recovery was ascribed to immigration by adults and/or settlement of larvae. Where larval settlement was the primary mechanism, timing of the disturbance relative to the natural reproductive cycles locally would affect the duration of time needed for recovery.

Finfish

MDIFW did not request impact assessment for any freshwater species which might be found in freshwater reservoir. Maine DMR recommended impact assessment for five species of finfish which use the marine habitat. Those species were American eel (*Anguilla rostrata*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), winter flounder (*Pseudopleuronectes americanus*), and rainbow smelt (*Osmerus mordax*). In this document, the two herring species will be combined into a single assessment for "river herring" as they are generally grouped.
For the project area, MDMR asked that American eel impact analysis be focused on the "elver" lifestage as this is the stage during which eels attempt to migrate up into freshwater. After being spawned in the Sargasso Sea, leptocephalus larvae drift at sea for up to a year and are transported north by the Gulf Stream. Leptocephali larvae metamorphose into early unpigmented juveniles called glass eels as they approach the North American coast at 60-65 mm in length. Collette and Klein-MacPhee (2002)[6] describe that during this metamorphosis the body changes into a cylindrical form, alteration in head and jaw aspects occur, and the digestive tract becomes functional. Glass eels appear in southern New England in March at 50-90 mm in length. They migrate upstream primarily at night into freshwater were they feed, become pigmented (elvers), and slowly grow until sexually mature, which can take up to 20 years. However, they may reach maturity as small as 28-30 mm long for males and 45 mm for females. Glass eels and elvers use a wide range of temperatures, burrow into sand, mud, snags, plant masses and other bottom types during the day and in between upstream movements, and have been reported in salinities from 0 to 25 ppt according to Greene et al. (2009)[7]. Although there is not currently upstream passage infrastructure in place at the dams on the Little River in Belfast, young eels could still be present as they are known to be able to climb nearly vertical wetted structures to get upstream. Due to the depth and placement of the intake, it is unlikely that the proposed project would have a significant impact on elvers because they will already be developed swimmers able to avoid the intake.

Bigelow and Schroeder (1953)[8], Cooper (1961)[9], Collette and Klein-MacPhee (2002)[5] describe that alewife and blueback herring are very similar anadromous, euryhaline, coastal, pelagic fish that are

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[5] Wilber, DH and DG Clarke. 2007. Defining and Assessing Benthic Recovery Following Dredging and Dredged material Disposal. Proceedings of the 2007 Dredging Summit and Expos, Western Dredging Association. Pp. 603-618
[6] Collette, B.B. and G.K. Klein-MacPhee, Eds. 2002. Bigelow and Schroeder's Fishes of the Gulf Of Maine, 3rd edition. Smithsonian Institution Press, 748 pp.
[7] Greene, K.E., J.L. Zimmerman,R.W. Laney, and J.C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: A review of utilization, threats, recommendations for conservation, and research needs. ASMFC Habitat Management Series #9. 463 pp.
[8] Bigelow, H.B., and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin 53: 1-577.

difficult to distinguish from one another and occur in similar habitat. Since it is difficult to visually distinguish between the two species, they are often considered together under the name "river herring". Bigelow and Schroeder (1953)[7] states that spawning occurs in these species in late April to mid-May in Maine. This means that in the spring, adults could be moving through the project area on their way to the mouth of the Penobscot River. After spawning, adults return to sea while young-of-year remain in fresh water for several months before gradually descending to the ocean. Juveniles tend to immigrate in waves as early as June and as late as October. As the egg and larval stages only occur in freshwater, those juveniles which could exist in the project area on their way to the ocean will already be developed enough to be unaffected by the operation of the intake. Additionally, the in-water work window (November 1 – April 1) will ensure that migrating individuals will not be injured during construction.

Winter flounder come inshore during late winter and early spring to spawn and adults move offshore following spawning according to Pereira et al. (1999)[10]. Winter flounder eggs are both demersal and adhesive. They are laid in masses and stay on the seafloor during incubation. The incubation period is temperature dependent and typically lasts 2 to 3 weeks. When larvae emerge, they are planktonic, drifting in open water, but remaining close to the coves or inshore waters which they use as nursery habitat. They quickly become demersal as the metamorphosis from an upright swimming fish to a flat fish begins. Juveniles settle in shallow water and estuaries in very high densities. Some reports suggest that recently settled groups of young-of-year winter flounder can exceed densities of 1 individual per square meter. It is thought that most juvenile individuals overwinter in estuaries but some are documented to do so offshore. In the Gulf of Maine adults spawn from February through May, later than in more southern portions of the range. Additionally, spawning can occur in water shallower than 5 m in the Gulf of Maine. Spawning substrate and depth can be quite variable, but sandy substrate seems to be slightly preferred. Eggs are generally deposited in 90 m of water or less, often being as shallow as just a couple meters. Additionally, it is thought that spawning adults tend to choose to release eggs in areas with minimal flow to prevent recently hatched larvae from drifting far from suitable nursery habitat. The project area, with its mainly soft bottom, would likely be suitable habitat for the Winter flounder spawning and nursery habitat. As this species spawns during the proposed in-water work window (November 1 – April 1), the project is likely to disturb or displace some spawning individuals. However, the projects footprint is not very large when compared to the whole of Belfast Bay, so individuals should be able to flee and still spawn in adjacent equivalent habitat during construction. During operations some eggs and larvae may be impacted.

As described by Carlander (1969)[11], and Scott and Crossman (1973)[12], Rainbow smelt are schooling, pelagic fish that occupy inshore coastal waters. In spring, typically March-May in New England, they undertake significant migrations leaving coastal waters and traveling to freshwater streams to

[9] Cooper, R.A. 1961. Early life history and spawning migration of the alewife, *Alosa pseudoharengus*. Master's thesis. University of Rhode Island, Kingston, Rhode Island.

[10] Pereira, J. J., Goldberg, R., Ziskowski, J. J., Berrien, P. L., Morse, W. W., and Johnson, D. L. 1999. Essential Fish Habitat Source Document: Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-138. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

[11] Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology. Volume One. The Iowa State University Press, Ames, Iowa. 752p.

[12] Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. Bulletin 184. 966p.

spawn above the head of tide. Spawning rainbow smelt that come inshore during spawning season do have the potential to have their migration to upriver spawning areas affected by the project. If individuals come inshore in March, they may come into contact with construction activities. Although spawning occurs in freshwater, after hatching, larvae drift quickly to estuarine waters, making it possible for larvae to occur the project area. This will likely not be an issue during construction because eggs will not drift into the project area until after the end of the in-water work window (November 1 – April 1). However, once the facility begins operating, some may be impacted. Rainbow smelt serve as important forage for a wide variety of important predator species in the Gulf of Maine, which suggests that loss of individuals of this species could affect other species in the bay which use it as forage.

Impacts to finfish are expected to vary based on species. Of the species assessed, only winter flounder is expected to be present in the project area during construction. This species is known to spawn in the area during the in-water construction window. Although this species is expected to be in the vicinity, spawning adults are expected to self-relocate and should be able to successfully spawn in adjacent and equivalent habitat available in the bay. The other species are not expected to occupy the project area in significant numbers during construction, so minimal construction impact should occur. Overall, the impact from construction on the species assessed is expected to be insignificant.

After the facility begins operation of the intake, the only ongoing potential for loss of finfish due to project operations would of by eggs and larvae. The intake is engineered to have a through screen velocity of less than 0.5 ft/sec, which will effectively minimize the chance for adult fish to become stuck to the intake screen. The screen itself is proposed to be a 1 inch slot size wedge wire mesh allowing smaller than 1 inch eggs and larvae to enter the intake. It is not expected that mortality would occur due to temperature, rather, eggs and larvae would be lost at the intake. The most likely species to experience this impact would be winter flounder and rainbow smelt as these species are likely to have the egg and/or larval life stages present in the vicinity of the intake. There is some chance that young glass or elver stage eels could be impacted by the intake, but it is unlikely that this would be significant as their swimming ability should be developed enough for them to avoid the screen due to the low intake velocity. The significance of impact of early life stages at the intake cannot be accurately quantified, as no ichthyoplankton data were collected for this project. Once the aquafarm begins operating, the cleaned discharge water is not expected to significantly impact water quality for finfish in the area.

Shellfish

Maine Department of Marine Resources (DMR) recommended impact assessment for four species of shellfish. Those species are American lobster (*Homarus americanus*), Atlantic sea scallop (*Placopecten magellanicus*), blue mussel (*Mytilus edulis*), and softshell clam (*Mya arenaria*). According to MDMR, softshell clams are mapped and known to be present in the area of the proposed project's intake and discharge pipelines. There is one blue mussel farming lease approximately 2 miles from the project area. Although blue mussels are not mapped by DMR in the immediate project area, it is possible that they would use this habitat.

MacKenzie and Moring (1985)[13] describes that the American lobster uses a wide variety of substrate. Additionally, Chang et al. (2010)[14] discusses the many habitat variables which are correlated with the presence or absence of lobsters at various size classes and life stages. Although no lobsters or burrows were observed during the pipeline habitat survey conducted by Normandeau Associates, the literature suggests that the project area could be suitable for some life stages of this species. As eggs of this species hatch from May to October, it is not expected that the in-water construction will significantly impact lobster in the project area. Individuals present during the November 1st through April 1st in-water construction window are most likely to be fully or nearly fully developed, making them mobile enough to self-relocate to a safe distance from construction activities. After the facility begins operating, some early planktonic larva may be impacted. Adult lobsters are expected to be able to navigate across the pipe, as the rock-filled marine mattress that will be used to hold the pipes in place provides a rough surface which lobsters can climb. The interface of the mattress edge and the natural substrate may also provide suitable burrowing habitat for lobsters.

Mortality of individuals of the four shellfish species in question is not likely to occur strictly from the temporary increase in TSS during construction activities. Juvenile and adult lobsters will self-relocate during construction, thereby minimizing the chance for significant impact. Scallops, blue mussels, and softshell clams will be able to modify their behavior to temporarily endure the change in water conditions until their area of residence is no longer part of the active construction zone. Once the aquafarm begins operating, the cleaned discharge water is not expected to impact shellfish in the area. If loss of adult shellfish is observed, it is most likely to occur by the individual being physically crushed by a piece of equipment used during in-water construction. As an impact mitigation measure, this project will restrict all in-water work in the marine environment to November 1st to April 1st. Construction activities are not expected to significantly impact the shellfish community in the area. After construction is complete, all shellfish should be able to resume routine use of the project area.

During facility operation the only ongoing potential for loss of shellfish due to project operations would be the loss of eggs and larvae at the intake. The intake’s less than 0.5 ft/sec engineered intake velocity will minimize the chance for adult shellfish to become stuck to the intake screen. The screen itself is proposed to be a 1 inch slot size wedge wire mesh, which will be too large to reduce the intake of larval and egg life stages. As mentioned for finfish the significance of this impact cannot be accurately quantified at this time, as no ichthyoplankton data were collected for this project.

No commercial shellfisheries are expected to be negatively affected by the project because the proposed project area is located within an area which MDMR has classified as a prohibited shellfish growing area.

Conclusion

The proposed project will include impacts that are either temporary or permanent. Temporary impacts will include those that occur only during construction. This would include increases in total

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[13] MacKenzie, C., and J.R. Moring. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic) --American lobster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.33). U.S. Army Corps of Engineers, TR EL-82-4. 19 PP.

[14] H. Chang, J & Chen, Yong & Holland, Daniel & Grabowski, Jonathan. (2010). Estimating Spatial Distribution of American Lobster Homarus Americanus Using Habitat Variables. Marine Ecology Progress Series. 420. 10.3354/meps08849.

suspended solids, increased noise, temporary loss of habitat, and potentially some mortality of sessile organisms that experience physical contact with construction equipment. The overall footprint of the temporary impact is expected to be approximately 108,000 ft2 along the 2,700 linear feet of pipe which will be buried after construction. This section will be backfilled to return the seafloor to its original condition after installation of the pipes.

Permanent impacts will include any impacts that will exist in perpetuity after construction has concluded and the facility has begun operating. Permanent impacts expected from this project will include the alteration of approximately 144,000 ft2 of habitat along the 3,600 linear feet of pipe which will remain anchored above the substrate on the seafloor. Additionally, any minimally developed life stages (eggs and larvae) which drift by the facility's seawater intake could be lost at the intake.

5.0 Benthos

5.1 Benthos Methods

On November 28 and 29, 2018 sediment cores were taken using a vibracore. Eight samples from Belfast Bay were taken with a 4-inch diameter core: seven samples along the proposed pipeline route at the time (A6, A7, A8, A9, A10, A11, and A12) and one sample approximately 750 ft north of the pipeline (B3) (see Figure 2). Firm substrate with large cobbles prevented obtaining samples from locations A1, A2, A3, A4, A5, B1, and B2. The top 6 inches of each core were thoroughly washed in the field through a 500-micron mesh sieve and preserved in rose bengal stained, 10% buffered formalin. Samples were shipped for processing to the Normandeau Biological Laboratory in Bedford, NH, with appropriate chain of custody forms.

The pipeline route has since been updated; previous Stations 16+00 through 41+00 (corresponding to sampling Stations A3 through A10) have been shifted to the north up to approximately 1,000 ft (305 m) at the farthest point (Station 23+00 – see Figure 3). Although benthic sampling Stations A6 through A10 are no longer along the current proposed pipeline, based on the similarity among samples taken, it is very likely that the benthic habitat along the current pipeline is very similar to sampling locations up to 1,000 ft to the south and provides an adequate representation for this analysis.

In the laboratory, macroinvertebrates were washed through a 500-micron mesh sieve. All soft substrate macrofaunal organisms were identified to the lowest practical taxon (usually species) and enumerated, with the exception of groups which, by convention, are identified to higher taxa (e.g., nemerteans, nematodes, and oligochaetes). Immature or damaged specimens missing the necessary diagnostic features for identification to the target taxonomic level were identified to the lowest practical taxon. Quality control checks were performed on 10% of all samples processed, with at least 90% of the organisms from each sample being removed.

5.2 Benthos Results

5.2.1 Habitat Available

The intertidal substrate along the project pipe route is firm sand with an abundance of cobble and some boulders. A Coastal Wetland Characterization – Intertidal and Shallow Subtidal Check list was completed (Appendix B). The deeper portions of the subtidal substrate along projected pipe path was determined based on sediment cores and underwater video and is characterized as mostly homogenous sandy/silty/muddy sediment with cobble mixed in.

5.2.2 Benthic Organisms Present

Overall, abundance of benthic organisms was relatively low (Table 4). A total of 18 species or species groups were identified: two nemerteans (ribbon worms), 12 annelids (including 10 polychaetes, one oligochaete, and one archannelid, a primitive form of polychaete), one gastropod (snail), and three bivalves (clams). The mean number of individuals per sample ranged from 1.0 at Stations A7, A8, A10, and B3 to 12.8 at Station A11 (Table 4). Two species groups accounted for a majority of the abundance: bivalves (57%) and polychaetes (including archiannelida, 37%). Two species, bivalve *Nucula proxima* and polychaete *Aricidia (Acmira) catherniae* were recorded in


N
B1
B2
B3
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
0 250 500 1,000 1,500
Feet
Nordic Aquafarms
Belfast, Maine
Sediment Sample Locations
Sediment Location Sampled
Sediment Location Not Sampled
Current Pipeline Route
NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Figure 2.

relatively high numbers compared to other taxa. *N. proxima* (Atlantic nut clam) accounted for 98%of bivalves, ranging from 1 individual (sample A8) to 51 individuals (sample A12) per sample. The Atlantic nut clam occurs in muddy habitats from Nova Scotia to Florida, and reaches approximately ¼ inch in length (Abbott 1974)[15]. Similarly, *A. catherinae* accounted for 59%of polychaetes, with 30 individuals recorded in one sample (A6). This species is a deposit feeder commonly found in the waters of Northeast US (Pembroke et al. 2013[16]; Maurer and Leathem 1980)[17].

[15] Abbott, R.T. 1974. American Seashells The marine Mollusca of the Atlantic and Pacific Coasts of North America. Van Nostrand and Reinhold Company, New York. 663 pp.

[16] Pembroke, AE, RJ Diaz, and EC Nestler. 2013. Harbor Benthic Monitoring Report: 2012 Results. Boston: Massachusetts Water Resources Authority. Report 2013-13. 41 pages.

[17] Maurer, D. and W. Leathem. 1980. Dominant Species of Polychaetous Annelids of Georges bank. MEPS (3): 135-144.

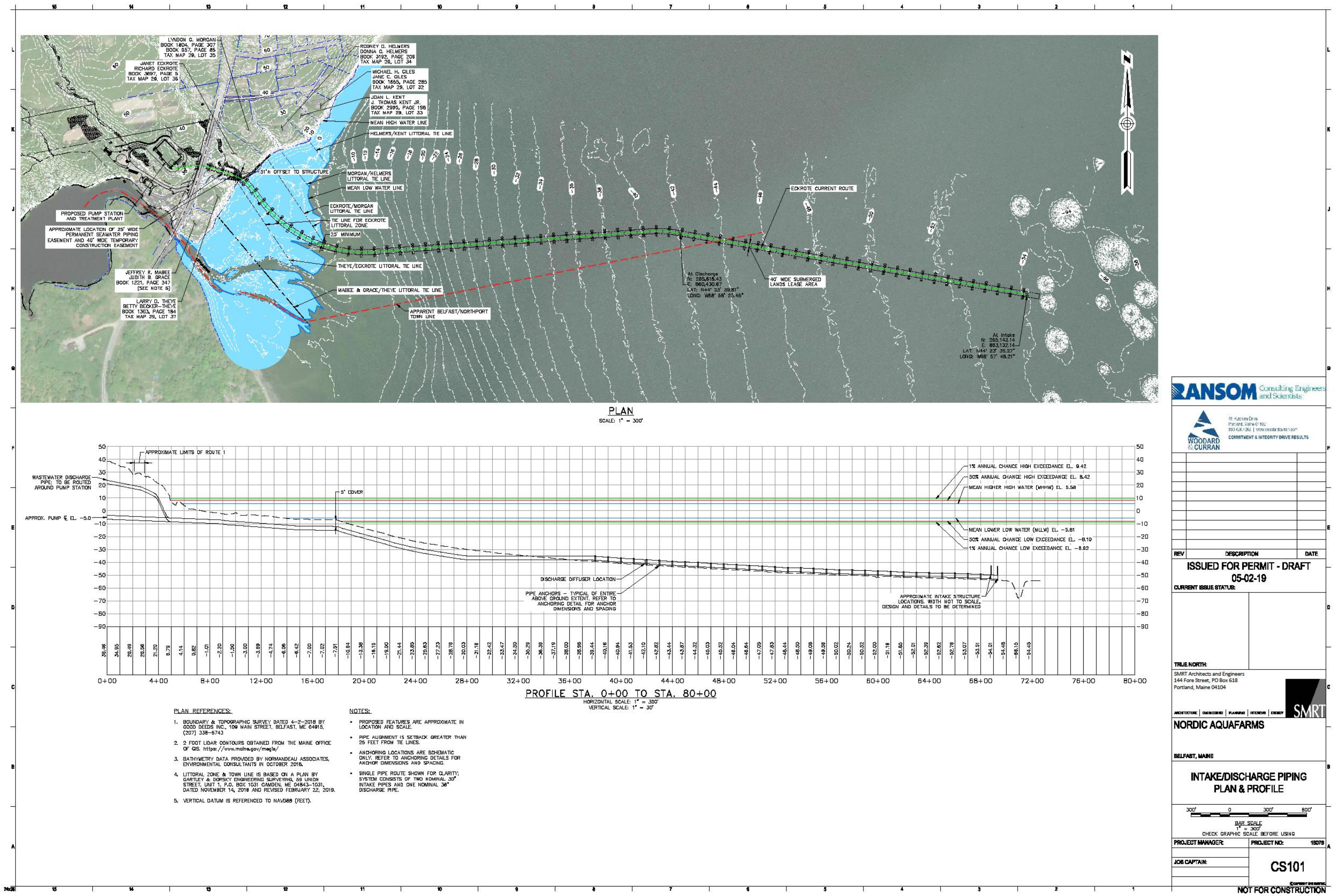
PLAN
SCALE: 1" = 300'
PROFILE STA. 0+00 TO STA. 80+00
HORIZONTAL SCALE: 1" = 300'
VERTICAL SCALE: 1" = 30'
EXCROTE CURRENT ROUTE
THEYE/ECKROTE LITTORAL TIE LINE
MABEE & GRACE/THEYE LITTORAL TIE LINE
APPARENT BELFAST/NORTHPORT TOWN LINE
PROPOSED PUMP STATION AND TREATMENT PLANT
MEAN HIGH WATER LINE
MEAN LOW WATER LINE
DISCHARGE DIFFUSER LOCATION
1% ANNUAL CHANCE HIGH EXCEEDANCE EL. 9.42
50% ANNUAL CHANCE HIGH EXCEEDANCE EL. 8.42
MEAN HIGHER HIGH WATER (MHHW) EL. 5.58
MEAN LOWER LOW WATER (MLLW) EL. -5.61
50% ANNUAL CHANCE LOW EXCEEDANCE EL. -8.19
1% ANNUAL CHANCE LOW EXCEEDANCE EL. -8.60
PLAN REFERENCES:
NOTES:
RANSOM Consulting Engineers and Scientists
WOODARD & CURRAN
ISSUED FOR PERMIT - DRAFT
05-02-19
NORDIC AQUAFARMS
BELFAST, MAINE
INTAKE/DISCHARGE PIPING PLAN & PROFILE
CS101
NOT FOR CONSTRUCTION

Figure 3.

Table 4. Abundance (Number of Organisms Per 4"x6" Core; 0.500mm mesh) of Benthic Macrofauna. Belfast Bay, Maine, November 28-29, 2018.

Taxon	Site A							Site B
	A6	A7	A8	A9	A10	A11	A12	B3
Nemertea								
Cerebratulus lacteus							1	
Fragilonemertes rosea					1			
Annelida								
Polychaeta								
Ampharete finmarchica							3	
Aricidea (Acmira)catherinae	30							
Bipalponephtys cornuta		1					1	1
Cirratulidae	1				1			
Eteone longa		1					1	
Heteromastus filiformis	1					1		
Levinsenia gracilis				1				
Nephtys incisa		1			1			
Ninoe nigripes					1	2		
Spiophanes bombyx	3							
Oligochaeta								
Oligochaeta	5							
Archiannelida	19							
Mollusca								
Gastropoda								
Frigidoalvania pelagica						1	4	
Bivalvia								
Ameritella agilis	1							
Arctica islandica							1	
Nucula proxima			1	4	3	47	51	
Total Abundance	**60**	**3**	**1**	**5**	**7**	**51**	**62**	**1**
Mean number of individuals per sample	**8.6**	**1.0**	**1.0**	**2.5**	**1.4**	**12.8**	**8.9**	**1.0**

Impacts to the benthos in the project area during construction and operation of the Nordic Aquafarms salmon aquaculture facility will be both temporary and permanent. The temporary impacts, including increased turbidity during dredging, rock removal, and pipe burial; and underwater noise from dredging, hoe ramming, pile driving, and construction vessels will be short-term and occur only during construction (from November 1 through April 1).

The permanent impacts will include the loss of soft bottom habitat, converting to hard substrate with the two intake pipes and one discharge pipe. The loss of this area is minimal considering the amount of similar available habitat throughout Belfast Bay.

Appendix B
Wetland Photo Log

Photo #: 1

Wetland W1, view of cleared area for geotechnical investigation.

Photo #: 2

Wetland W2, deciduous area, saturated soils

Photo #: 3

Wetland W3, extending along access road prior to flowing into forest

Photo #: 4

Wetland W4, area exhibiting signs of ponding. Note shallow rooting in foreground.

Photo #: 5

Wetland W5 – wetland vegetation throughout a young balsam fir plantation.

Photo #: 6

Wetland W6 – a broad wetland area receives and dissipates stream flow.

Photo #: 7

Wetland W7 surrounding stream S8

Photo #: 8

Wetland W8 – fringe of Stream S9

Photo #: 9

Wetland W9, Straem S9

Maintenance building in background

Photo #: 10

Typical morphological adaptation (surface roots) in response to high water table. Photo taken in Wetland W1, but evident elsewhere.

Photo #: 11

Drainage D1 – Dry with organic substrate

Photo #: 12

Drainage D2 depicting low flow conditions, organic substrate

Photo #: 13

Drainage D3
near confluence
with Drainage D2.

Photo #: 14

Drainge D3, ephemeral

Photo #: 15

Drainage D4, dry

	**Photo #: 16** Stream S5, well defined channel but very low flow
	**Photo #: 17** Stream S6 near the transition from drainage to intermittent stream flow
	**Photo #: 18** Drainage D7 showing siltation from upstream land uses (agriculture, field)

Photo #: 19

Stream S8, braiding through wetland W7

Photo #: 20

Stream S9 near entrance to the Belfast Water district. It is a channelized ditch at this point.

Photo #: 21

Stream S9 – incised banks upstream from Route 1, naturalized.

	**Photo #: 22** Wetland W10 in broader floodplain
	**Photo #: 23** Wetland W10 near edge of salt marsh
	**Photo #: 24** Wetland W11, typical salt marsh vegetation

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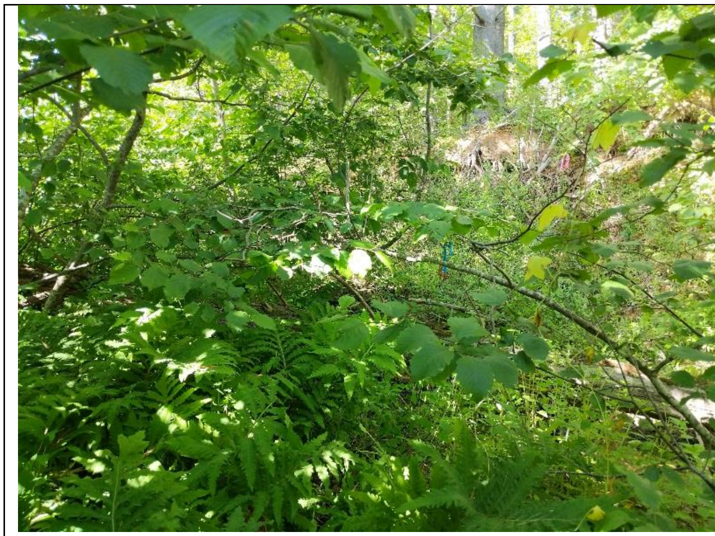
<tr><td rowspan="2"></td><td>Photo #: 25</td></tr>
<tr><td>Wetland W12, dense vegetation along streambank</td></tr>
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<tr><td rowspan="2"></td><td>Photo #: 26</td></tr>
<tr><td>Wetland W12 Narrow wetland edge to stream channel</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>Photo #: 27</td></tr>
<tr><td>Stream S9 Culvert beneath driveway on 282 Northport Rd</td></tr>
</table>

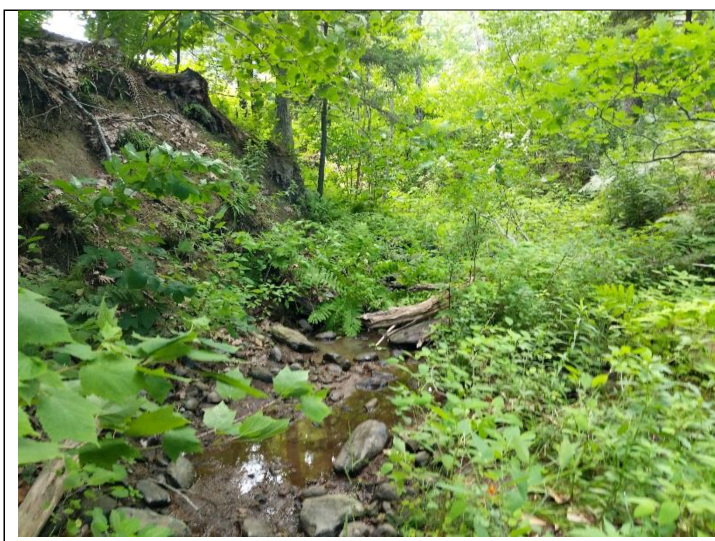
	**Photo #: 28** Stream S9 flowing into saltmarsh
	**Photo #: 29** Stream S6 Dry bed
	**Photo #: 30** Stream S6 Low flows

Photo #: 31

Wetland W13
facing west

Photo #: 32

Wetland W13
facing south

Photo #: 33

Wetland W13
facing west

	**Photo #: 34** Wetland W1 facing north
	**Photo #: 35** Wetland W15 facing north
	**Photo #: 36** Wetland W15 facing south

	**Photo #: 37** Wetland W16 facing north
	**Photo #: 38** Wetland W16 facing south
	**Photo #: 39** Wetland W17 facing north

	**Photo #: 40** Wetland W17 facing south
	**Photo #: 41** Wetland W17 facing north
	**Photo #: 42** Wetland W17 facing south

Photo #: 43

Stream S9 from facing north (upstream)

Photo #: 44

Stream S9 facing south (downstream)

Photo #: 45

Stream S10 facing southeast (downstream)

Photo #: 1

Intertidal Area Facing Westerly

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Photo #: 2

Intertidal Area Facing Easterly

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Appendix H
Bathymetric Survey

Bathymetric Survey of Little River and Belfast Bay

Confidential Aquaculture Project

Prepared For
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10-April-2018

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1 Introduction

In support of the due diligence work being undertaken at the potential Confidential Aquaculture site to identify possible water intake and outfall pipe locations, Normandeau was contracted to supply information regarding the bathymetry of Belfast Bay from the Little River dam out to the 45-65 feet depth zones off the coastline. Bathymetric information for Belfast Bay will be used to identify specific sites for further survey work including bottom type assessment and current flow characteristics.

2 Methods

The initially proposed survey area for the bathymetric covered the region extending downstream from the Belfast Water District dam on Little River (just upstream of US Highway 1) offshore to the 50 foot depth relative to mean lower low water (MLLW) region in Belfast Bay, with equal coverage north and south of the river mouth. The planned coverage area in Belfast Bay was revised to increase aerial coverage of the 45 to 60 foot depth region and to move the transects further south where the target water depths were expected to occur closer to shore. Transect locations were based on depth soundings on NOAA Nautical Chart 13309 for Penobscot River (NOAA 2016). Additional sampling effort was concentrated around the bottom depression indicated on the NOAA chart as 86 feet deep and located approximately 2.5 km (1.6 miles) offshore east of the Little River mouth. Sampling within the Little River was planned to be conducted near high tide for vessel accessibility and to maximize coverage. Vessel track and planned transects were delineated using Hypack (YSI, Inc.) software to assist with navigation and allow real-time display of sampling progress and data collection.

Depth soundings were collected using a 200 kHz Sonarmite single-beam echosounder (Seafloor Systems, Inc.) with a 9° beam angle and georeferenced by RTK-GPS using a Leica Viva GS15 GNSS smart antenna. The Sonarmite transducer was deployed 0.4 m below the water surface using a pole mount clamped to the starboard gunnel of an 18 ft Carolina Skiff. The sound speed used for depth measurements was corrected using a surface water temperature of 3°C (37°F) measured on-site, and a salinity of 31 PSU as reported by NOAA Station 44033 Buoy F01 in Penobscot Bay (NOAA 2018a). The RTK-GPS station was attached to the top of the same pole at a height of 1.1 m above the water surface. Depth and GPS data were displayed in real-time and recorded using Hypack Survey software. RTK-GPS data (NMEA GGA format using WGS 1984 geographic coordinate system) were projected in Hypack Survey software onto the UTM-NAD83 Zone 19 grid with GRS-1980 reference ellipsoid. The RTK Tide Method in Hypack used the g2012b-CONUS geoid model and the VDatum zone "Maine, New Hampshire, Massachusetts – Gulf of Maine, Version 1.3" with a Mean Lower Low Water chart datum. Tide data from the Belfast, Penobscot Bay NOAA Station 8415191 were applied to raw depth readings to correct for water surface height above MLLW at the time of data collection (NOAA 2018b). Raw depth data were adjusted using tidal data in Hypack Single Beam Editor, and plots of the corrected depth values over time were visually assessed to remove erroneous data points.

Bathymetry contour maps were created using the Spatial Analyst extension in ArcMap (v10.6; ESRI, Inc.). The Inverse Distance Weighting (IDW) circular smoothing procedure was used to interpolate depths between transects and to create a small-scale grid of depths for the entire survey area. From this interpolated grid, 1 ft contours were created to characterize the depths within the survey area.

3 Results

Bathymetry data in the Little River and Belfast Bay were collected between 0940 and 1430 on 28 March 2018. The total length of transects sampled was approximately 450 m in Little River and 35,000 m in Belfast Bay (Figure 1). Tide-corrected depth soundings indicated numerous bottom depressions ("pockmarks") along all transects at distances >2 km offshore from the mouth of Little River (Figure 1). The frequency and depth of the pockmarks relative to the nominal seafloor depth appeared to increase with distance from shore, and were particularly present in the southeast region of the area surveyed. A 2006 USGS bathymetric survey in Belfast Bay described individual pockmarks to be crater-like and circular with diameters ranging from 16 to 258 m and depths relative to nominal seafloor of 1 to 19 m (Andrews 2010). Connected chains of pockmarks were also identified by the USGS survey, with one of these chains running NW to SE through the present bathymetry survey area. Depth soundings from the present survey indicate that the locations and depths of the pockmarks have remained largely unchanged since 2006. Although the USGS survey did not cover the southwest region covered by the present survey, depth soundings along the southern transects indicate the pockmark chain continues through to the south. The spacing between transects (approximately 100 m) did not allow the identification of all pockmarks within the survey area. Additionally, it was unlikely that a transect covered the deepest part of any of the pockmarks that were identified. Because of these factors, the interpolation of depths between transects and resulting contours could not adequately represent the bathymetric complexity of the survey area.

Instead, only the depths of the plateaus between the pockmarks were used to create "nominal" depth contours for a generalization of the minimum-depth gradient of the survey area in Belfast Bay. The depth-distance plot for each transect was visually examined and all soundings associated with pockmarks were removed (Figure 2). Any erroneous depth sounding in the remaining data was removed and replaced by a value linearly interpolated between the previous and subsequent pings. From this reduced dataset, the ArcMap IDW procedure was used to create the interpolated depth grid of the entire survey area, and contours representing the generalized offshore gradient of the survey area were created (Figure 3). Depths along the single transect was surveyed between the mouth of the Little River and the offshore transects were not considered representative of the highly variable tidal zone, and no interpolation was performed for this region (Figure 3). Within the surveyed area, nominal depths generally increased with distance from the Little River mouth. The 45 ft depth contour was approximately 1.6 km (1.0 mi) offshore directly east of the Little River mouth, and approximately 2.0 km (1.2 mi) offshore to the southeast of the Little River mouth. However, depths >50 ft were closer to the Little River mouth in the southern portion of the survey area (2.6 km; 1.6 mi) compared to the northern portion (3.1 km; 1.9 mi). The 65 ft contour was only identified in the southeast corner of the survey area, and occurred at a distance of approximately 3.6 km (2.2 mi) from the Little River. Although pockmarks were found throughout the survey area in areas with nominal bottom depths > 40ft, pockmark density appeared to increase from north to south. Additionally, a chain of pockmarks forms a nearly continuous 65 to 110 ft deep trench that cuts through the 50 to 55 ft nominal depth zone for the entire southern half of the survey region. The maximum depth of the Little River channel between the dam and Belfast Bay was 3 ft relative to MLLW, with much of the channel above the water line around low tide (Figure 4).

4 References

Andrews, B.D., L.L. Brothers, and W.A. Barnhardt. 2010. Automated feature extraction and spatial organization of seafloor pockmarks in Belfast Bay, Maine. Geomorphology. 124:55-64.

National Oceanic and Atmospheric Administration (NOAA). 2016. Penobscot River Nautical Chart, 30th Ed. Office of Coast Survey website. http://www.charts.noaa.gov/OnLineViewer/13309.shtml . Accessed February 2018.

NOAA 2018a. Station 44033 - Buoy F01 - Penobscot Bay. National Buoy Data Center website. http://www.ndbc.noaa.gov/data/realtime2/44033.ocean accessed March 2018.

NOAA 2018b. Tides and Currents – NOAA Tide Predictions for 8415191 Belfast, Penobscot Bay, ME. https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8415191 accessed March 2018.

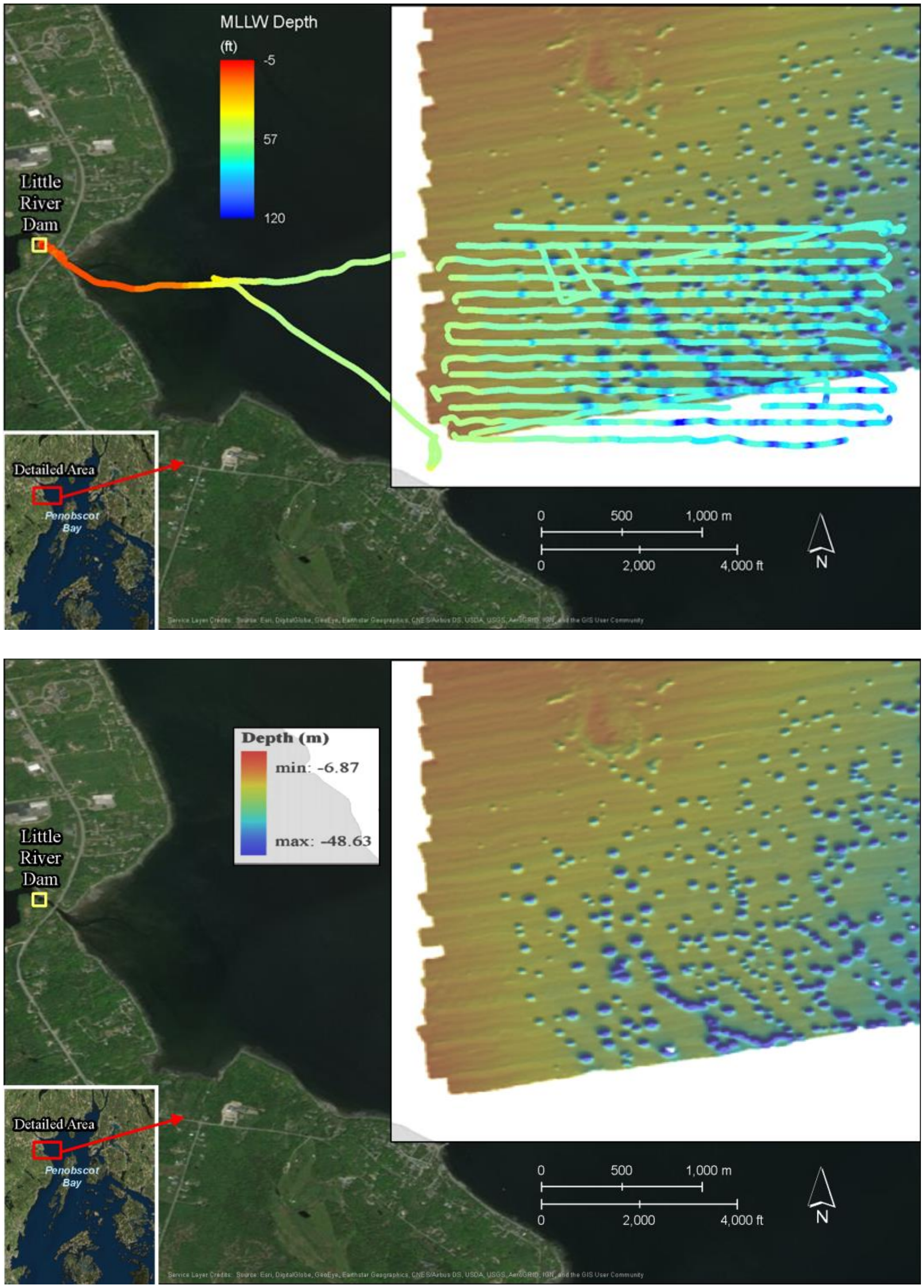

Figure 1. Location of transect (colored lines, top image) coverage for the bathymetric survey conducted on Belfast Bay on 28 March 2018, overlaid on USGS data collected in the area in 2006 (upper right of both images; Andrews et al. 2010) to show the correspondence of pockmarks identified during both surveys. Note the color scale in the top image is for depths (in feet) for the 2018 survey, and the color scale in the bottom panel is for 2006 USGS data in meters.

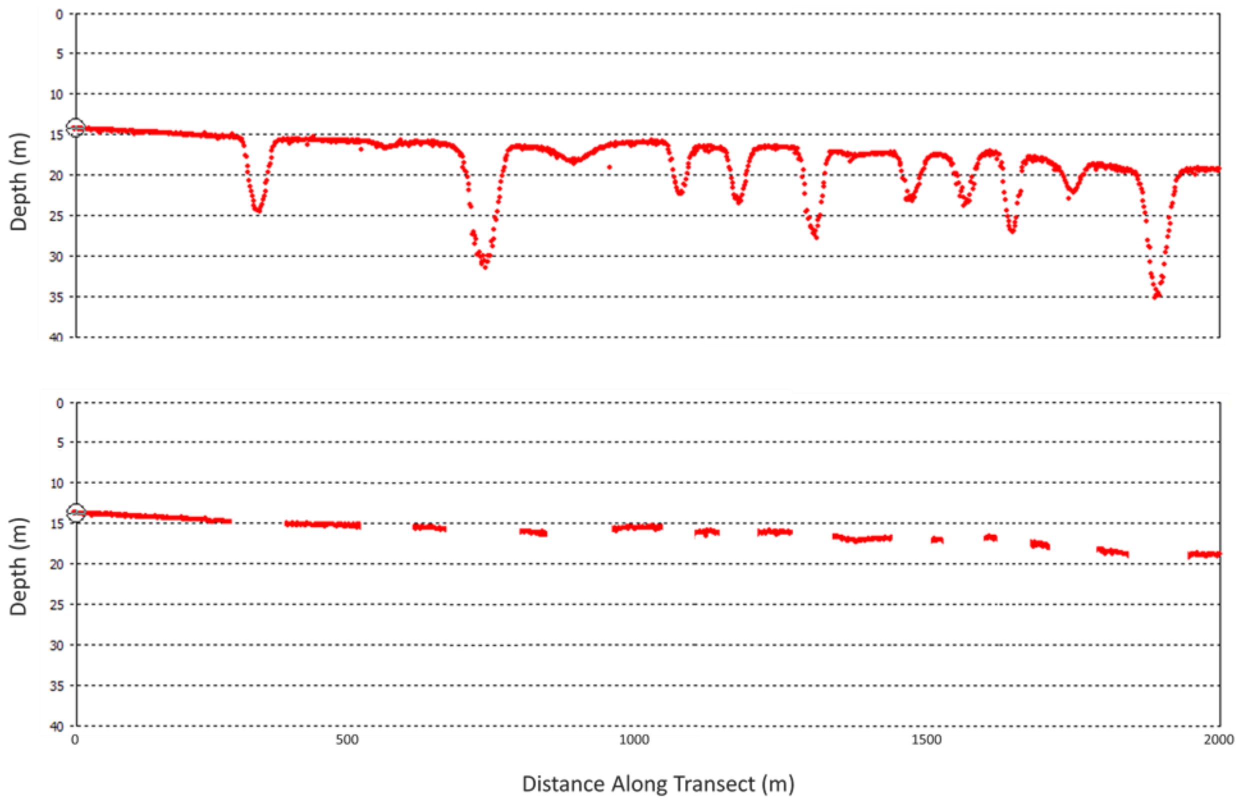

Figure 2. **Example of pockmark removal from data collected along an east-west transect used to identify the "nominal" depth gradient for the survey area covered on 28 March 2018.**

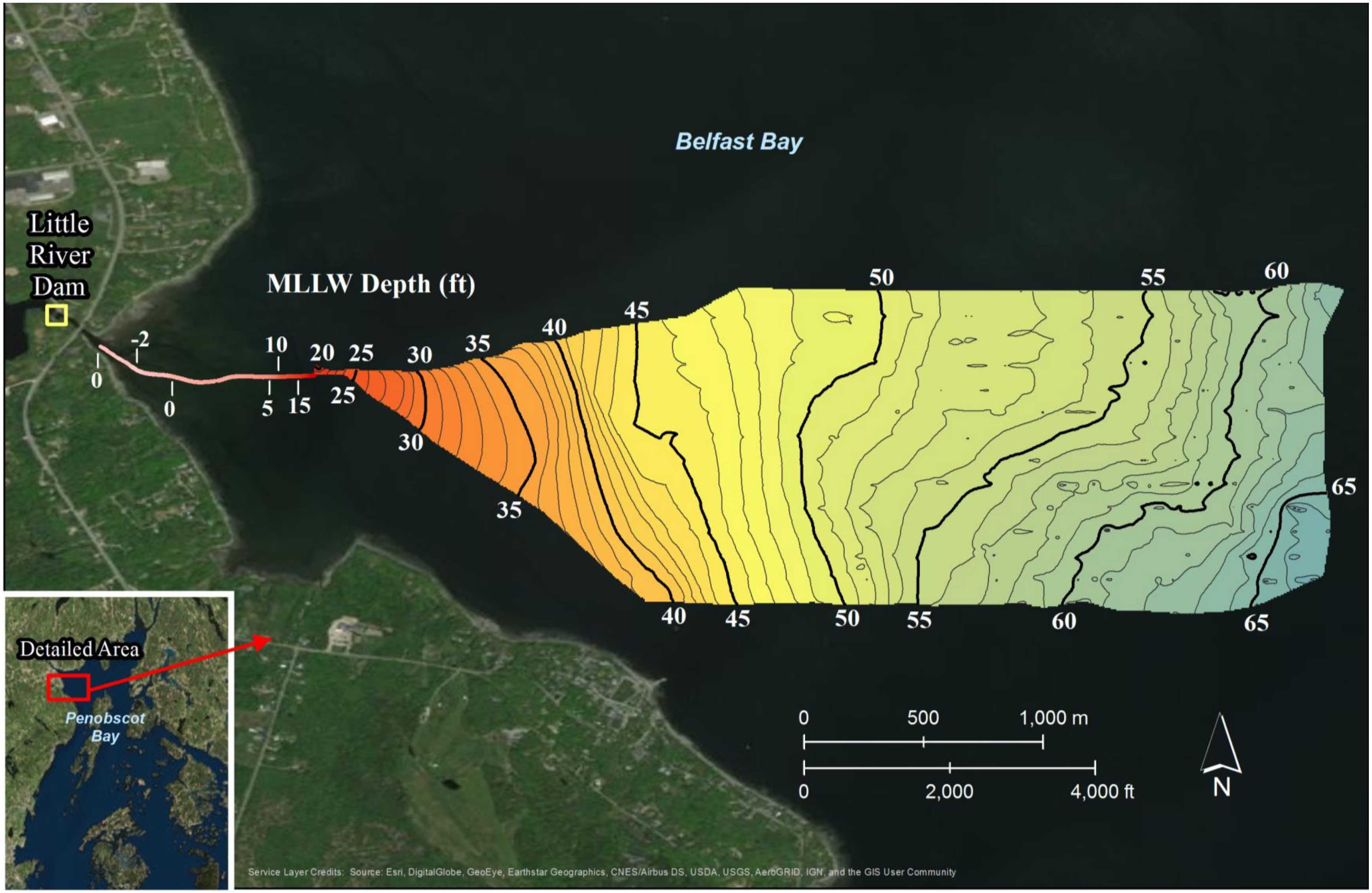

Figure 3. Nominal (i.e., pockmark data removed) depth contours in feet relative to mean lower low water (MLLW) created using bathymetric data collected on 28 March 2018 in Belfast Bay, Maine.

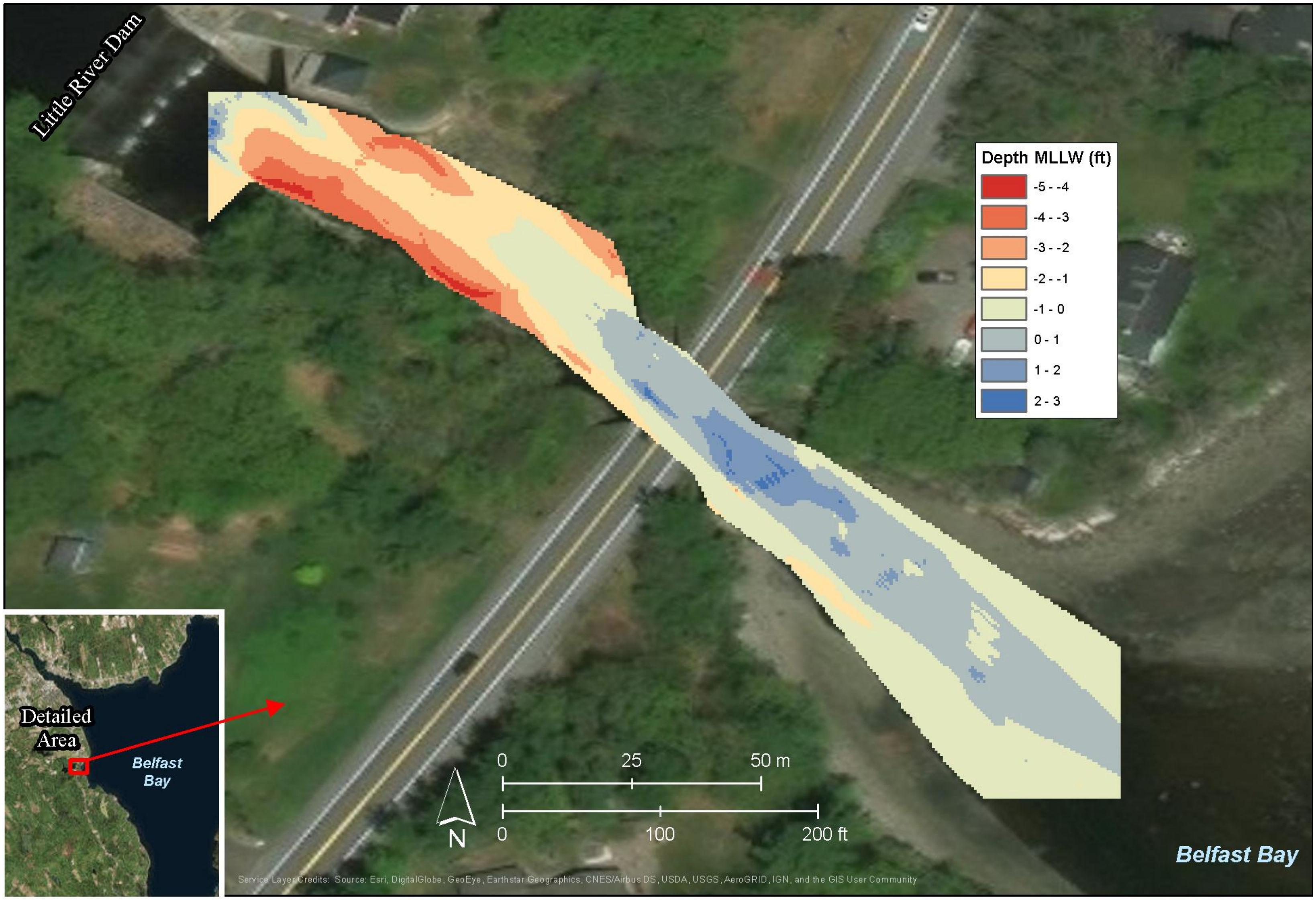

Figure 4. Depth regions in feet relative to mean lower low water (MLLW) created using bathymetric data collected on 28 March 2018 in the Little River between the dam (upstream) and Belfast Bay, Maine. Negative depths indicate channel areas that are above the water line at MLLW.