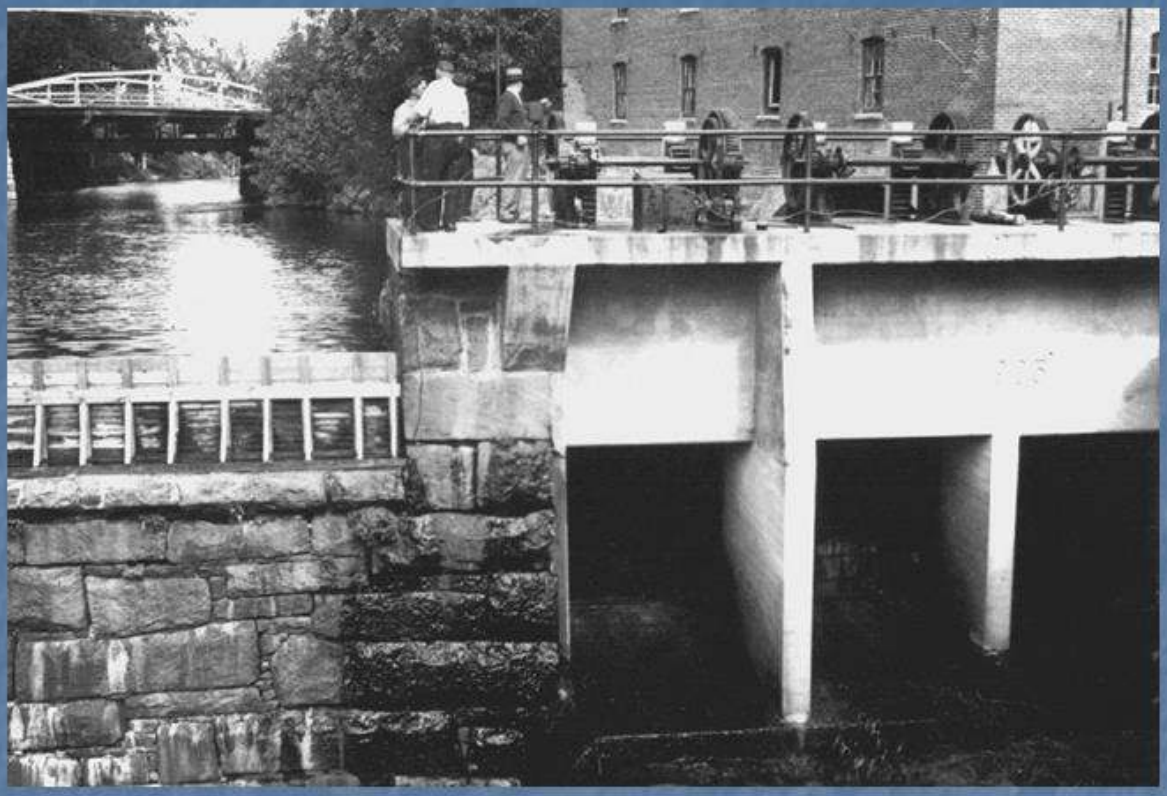
Technical Summary Memorandum
Dam Feasibility and Impact Analysis

Macallen Dam, Newmarket, NH



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Acronyms

EAP	Emergency Action Plan
FERC	Federal Energy Regulatory Commission
GSE	Gomez and Sullivan Engineers, P.C.
IDF	Inflow Design Flood
LOD	Letter of Deficiency
NHDES	New Hampshire Department of Environmental Services
NHDOT	New Hampshire Department of Transportation
NHFGD	New Hampshire Fish and Game Department
OMR	Operation, Maintenance and Response Form
PAD	Pre-Application Document
PAH	Polyaromatic Hydrocarbon
Town	Town of Newmarket
USGS	United States Geological Survey

Introduction

The Town of Newmarket (Town) contracted with Gomez and Sullivan Engineers, P.C. (GSE) to evaluate the feasibility of potentially removing Macallen Dam. A deliverable from this contract is the enclosed Technical Summary Memorandum. The purpose of the Technical Summary Memorandum is to summarize GSE's major findings from our review of the existing data, literature, past studies, and input received at the first public meeting on September 16, 2013. This document includes the following:

1) Photographic documentation of the dam and impoundment under full and partial drawdown conditions;
2) Findings from due diligence research relative to the potential for contaminated sediments in the river reach (impoundment) impounded by the Macallen Dam;
3) Summary of available New Hampshire Fish and Game Department's (NHFGD) migratory fish passage estimates for the past decade at the Macallen Dam fish ladder;
4) Summary of available water quality data in the project area;
5) Summary of available New Hampshire Department of Transportation (NHDOT) information on the Route 108 Bridge (Veterans Bridge) just upstream of Macallen Dam;
6) Summary of available dam inspection reports and findings;
7) Summary of any cultural resource work that is complete when this memo is produced.

Based on our review of past dam engineering reports and input received at the first public meeting, several other important topics have been noted. We have added sections to this memo to address these topics, including:

1) Review of past hydraulics and hydrology studies of the Macallen Dam; and
2) Potential hydroelectric generation at Macallen Dam.

Setting

The Macallen Dam is located on the Lamprey River in downtown Newmarket. Figure 1 is an aerial map of the impoundment. Figure 2 is a close up aerial view of the dam. Based on existing mapping and survey conducted under this contract, an existing conditions plan in the dam area was developed as shown in Figure 3. The dam is readily visible from Veteran's Bridge located immediately upstream of the dam, from the footbridge spanning the Lamprey River below the dam, and from various locations on each side of the river. There is considerable infrastructure development around the dam including buildings and parking lots as shown in Figure 2 and Figure 3. The dam creates an impoundment extending upstream approximately 2.5 miles up the Lamprey River and approximately 0.75 miles up the Piscassic River – a major tributary to the Lamprey River. The impoundment extends into Durham, NH and creates several backwater/bay

areas, including an impounded area nearly circling what is referred to as Moat Island. The dam's presence has considerably backed up the flow of water in the Piscassic River from its confluence with the Lamprey River to the bedrock falls that mark the upstream extent of the Macallen Dam impoundment.

There are several condominium or apartment complexes and residential houses (homes) flanking the impoundment in the lower portion of the Macallen Dam's impoundment. The river supports recreational activity as evidenced by docks located around the residences and a boat ramp at the end of Piscassic Street. In our three on-the-water site visits to the impoundment (summer weekend, summer weekday and fall weekday) there were several kayakers, canoeists and small motorized boats observed on the impoundment. Recreational boating appeared to be heavier on the weekends during the summer than during the summer or fall weekdays.

Dam Geometry and Description

The Macallen Dam is an approximate 27-foot high stone-block dam located in downtown Newmarket, NH. The current dam was constructed in 1887, as indicated by the engraved stone on the front of the dam[1]. The dam was constructed on or near what some history books have referred to as "the First Falls." Based on cursory research in preparing our proposal, historic documents suggest there have been dams located at or near this location perhaps as far back as the late 1600's.

The dam consists of three main sections (Figure 4, Figure 5, and Figure 6): the right[2] abutment, the spillway section, and the left abutment/gate section. The right abutment is a stone-block and concrete wall, which is structurally attached to the fish ladder. The right abutment has a crest elevation of 28.47 feet[3]. Immediately below the right abutment is a brick building currently housing a commercial business. The fish ladder appears to be structurally tied to the building on the right abutment, such that the concrete of the fish ladder appears to touch the building's foundation (Figure 7). The spillway is constructed of stone-block, with a crest elevation of 22.35 feet[4]. There is a small metal lip along the center of the spillway (crest elevation 22.42 feet) that further controls water levels. The lip appears to be a relic from when the dam had flashboards[5] installed. The left abutment/gate section is a stone-block and

[1] GSE received information during the October 2013 drawdown that there is at least one other date-engraved stone located under the normal water line on the right abutment with a slightly different year.
[2] When referring to the left or right side of the river, it assumes one is looking in a downstream direction.
[3] All elevations in this document refer to the North American Vertical Datum of 88 (NAVD88). The GSE survey used the Geoid12a geoid.
[4] A previous survey by Wright-Pierce indicated that the dam's crest elevation was approximately 22.18 feet, a difference of 0.17 feet. This difference may be explained by a combination of both surveys' measurement accuracy.
[5] Flashboards are commonly constructed of wood and are affixed to the spillway crest to raise the water level behind the dam typically to increase hydroelectric generation.

concrete section with three 7 foot by 7 foot manually-operated crest gates. The gates have a crest elevation of 16.15 feet and a top elevation of 23.15 feet. While the gates are 7 feet tall, the NHDES September 17, 2010 inspection report stated at the time that the gates cannot fully open and listed 5.5 feet above the crest as the maximum opening height (elevation 21.65 feet). The gates have since had extenders installed so that they can open the full 7 foot height (Personal Communication, R. Malasky, March 2014), with a maximum opening height of 23.15 ft. With a gate crest elevation of 16.15 feet and a spillway crest elevation of 22.42 feet (at the metal lip), the water level behind the dam can be lowered up to 6.3 feet. The left abutment, located above the gates, has a crest elevation of 30.20 feet.

The Macallen Dam is operated as a run-of-river facility, where inflow equals outflow on a near continuous basis. This means that water levels behind the dam are typically maintained at the spillway crest elevation or higher as inflow increases. If, for example, inflow to the dam was 30 cubic feet per second (cfs), then the discharge over the spillway would be approximately 30 cfs; no water is "stored" behind the dam. During floods, inflow exceeds the discharge capacity of the spillway and gates, and water backs up behind the dam—as experienced in the May 2006, April 2007, and March 2010 floods, among others.

Dam Hydraulics

The Macallen Dam has two means of passing water: the overflow spillway and the crest gates. During normal hydrologic conditions, flow passes exclusively over the spillway (or a small amount through the fish ladder during certain times of the year). During high flow or flood events, the crest gates are typically opened to allow more flow to pass without overtopping the dam abutments. During some recent extreme flood events (May 2006, April 2007, March 2010), the dam abutments were overtopped even with the gates open (Figure 8). The hydraulic modeling conducted as part of this study will be used to estimate the flow through the dam spillway and crest gates. The purpose of this section is to briefly describe the equations, assumptions and calculations that will be conducted as part of the hydraulic modeling at the dam.

Dam spillways are typically modeled as broad-crested weirs. The amount of water passing over a weir (note weir and spillway are used interchangeably) is calculated using the following equation:

$Q = CLH^{1.5}$, where

- Q = is quantity of flow passing over the weir (cfs),
- C= is the weir coefficient ($feet^{0.5}$),
- L= is the length of the weir (feet), in this case the length of the spillway is 70 feet, and
- H= is the depth of water above the weir crest (feet).

Figure 9 shows the dimensions on an example broad-crested weir.

The weir coefficient typically varies based on the depth of water above the spillway crest and the spillway geometry. While the dam's geometry is different than a typical broad-crested weir, we believe it is prudent (and slightly conservative) to model the dam spillway as a broad-crested weir. A typical weir coefficient for a broad-crested weir with minimal depth of water (H) over the spillway is approximately 2.63. In general, however, weirs become more efficient (higher C values) as the depth of water above the spillway crest increases. For depths of water (H) less than 4.0 feet, the dam will be hydraulically modeled with a weir coefficient between 2.48 and 3.32. For water depths (H) greater than 4.0 feet, the dam will be hydraulically modeled with a weir coefficient of 3.32. The resulting stage[6] versus discharge curve for the Macallen Dam spillway is shown in Figure 10. A detailed description on the weir coefficient used for the Macallen Dam is included in Appendix A.

The dam's crest gates are typically only opened during high flow or flood events, during which they are fully submerged (meaning the water moving through the gate openings are under pressure). Thus, they will be modeled as an orifice. Flow through an orifice is calculated using the equation:

$Q = CA\sqrt{2gh}$, where

- C= is an orifice coefficient (unitless),
- A= is the orifice area (feet^2), in this case, each gate has a usable orifice opening of 5.5 feet by 7 feet or 38.5 feet^2,
- G= is gravitational acceleration (32.2 feet/sec^2) and
- h= is the net head through the orifice (feet).

The orifice coefficient, C, will be approximated as 0.6, which is a typical value. The orifice area, A, is 38.5 feet^2 (7-foot wide x 5.5-ooft high) per gate. The net head, h, was calculated as if the orifice was submerged. A photograph from the March 2010 flood shows that flow through the gates is partially impeded (backwatered) by an angled wall on river left (Figure 11). The left and center gates are clearly impacted by the backwater, while it is unclear if the right gate is impacted by the backwater. We conservatively assumed that the downstream tailwater elevation is equal to the elevation of the open crest gate (21.65 feet) for all three gates. This means we are estimating less gate hydraulic capacity than if the angled wall was not present

[6] Stage refers to the water surface elevation above the spillway crest.

causing a backwater. The resulting stage versus discharge curve for the Macallen Dam gates is shown in Figure 12.

Figure 13 shows a combined gate and spillway stage versus discharge rating curve for the Macallen Dam. The graph shows that at approximately one foot below the right abutment (28.47 feet), the dam can pass approximately 3,458 cfs over the spillway and 1,452 cfs through the gates, for a total of 4,910 cfs. The figure also shows that as the water surface increases, the gates pass an increasingly small proportion of the flow passing over the dam. At an impoundment elevation of 28.4 feet, the gates can pass a maximum of approximately 30% (1,447 cfs) of the total flow passing the dam (4,863 cfs).

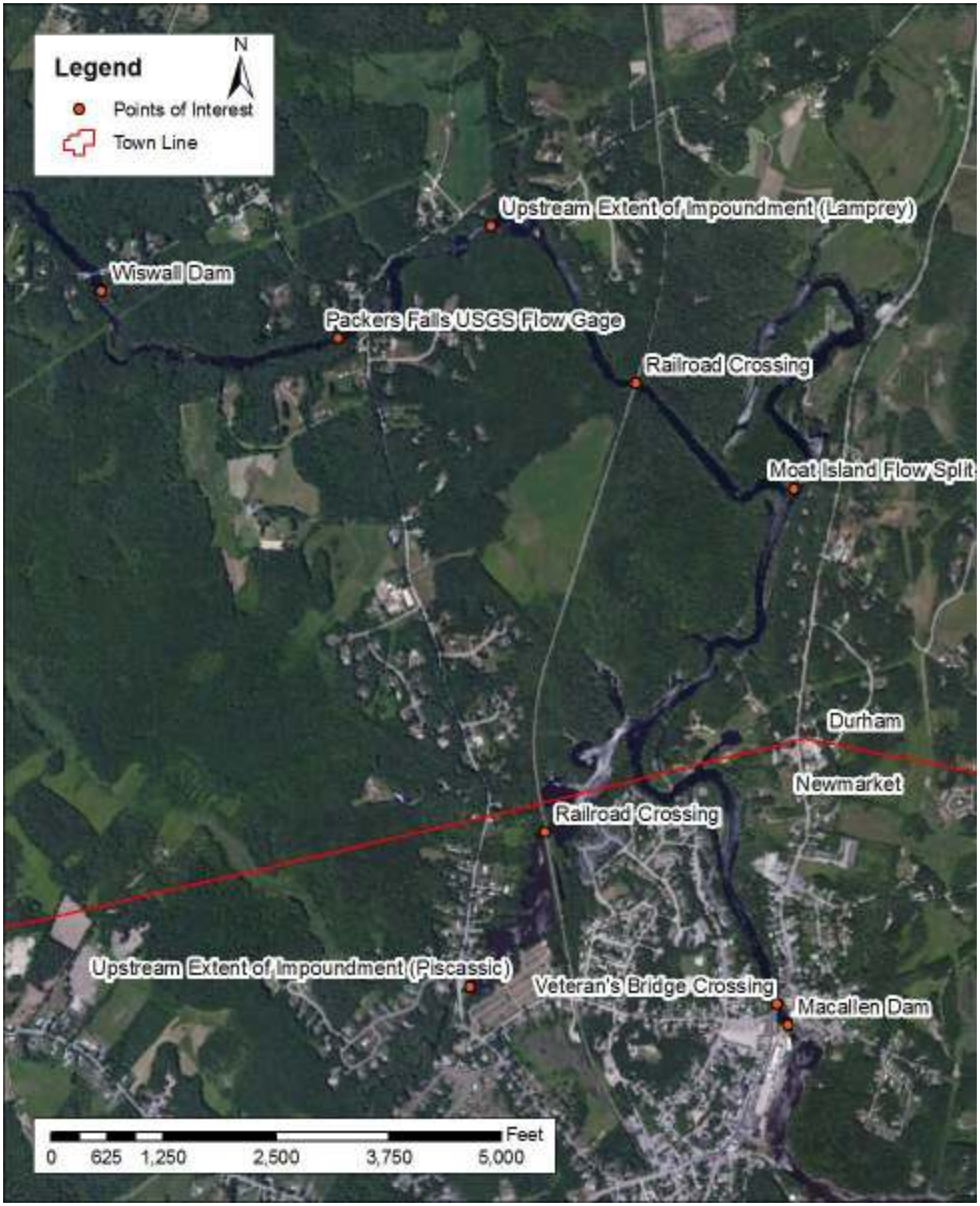

Figure 1: Dam and impoundment overview.

Figure 2: Aerial close-up of Macallen Dam.

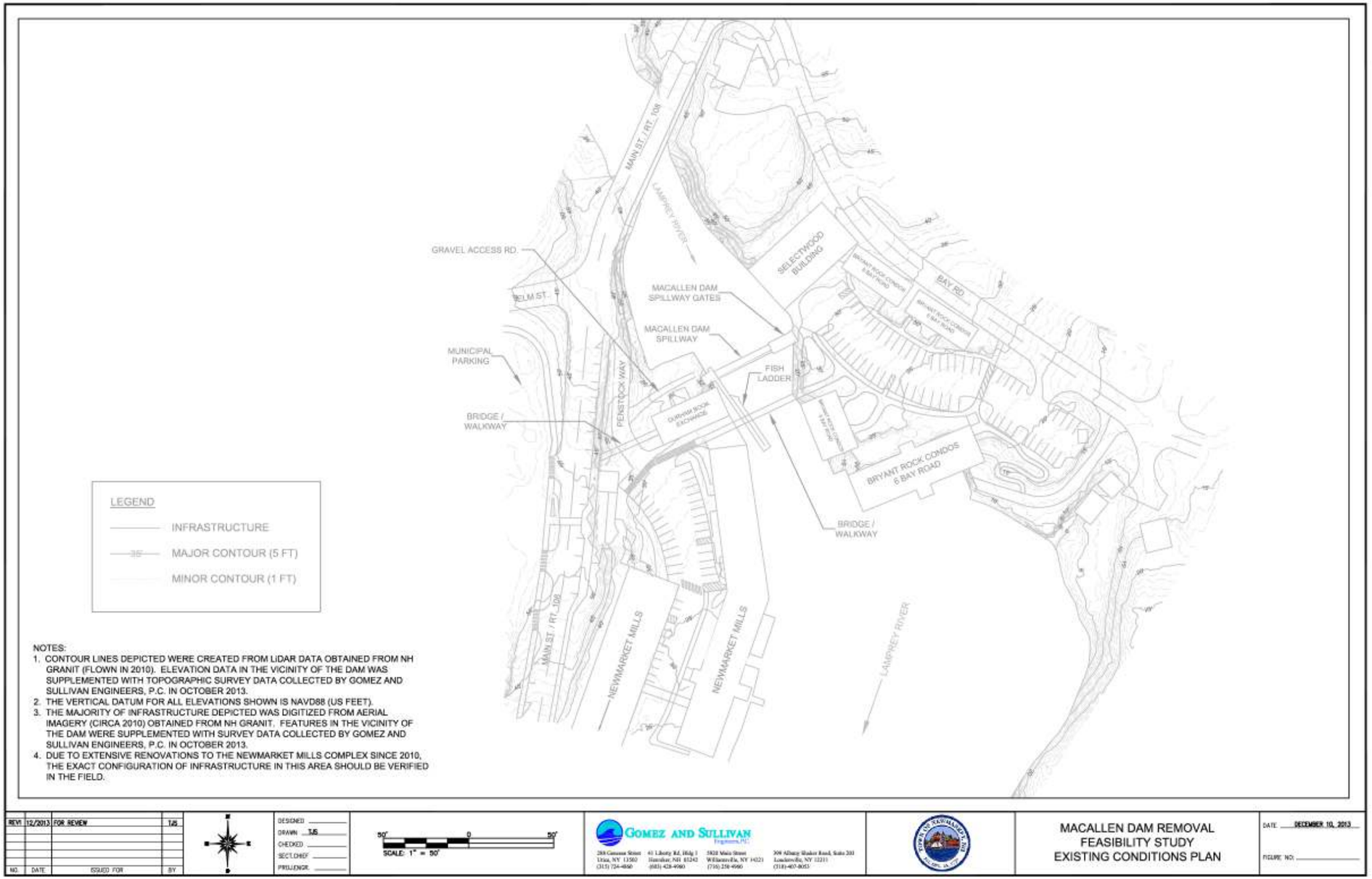

Figure 3: Existing conditions base map of Macallen Dam.

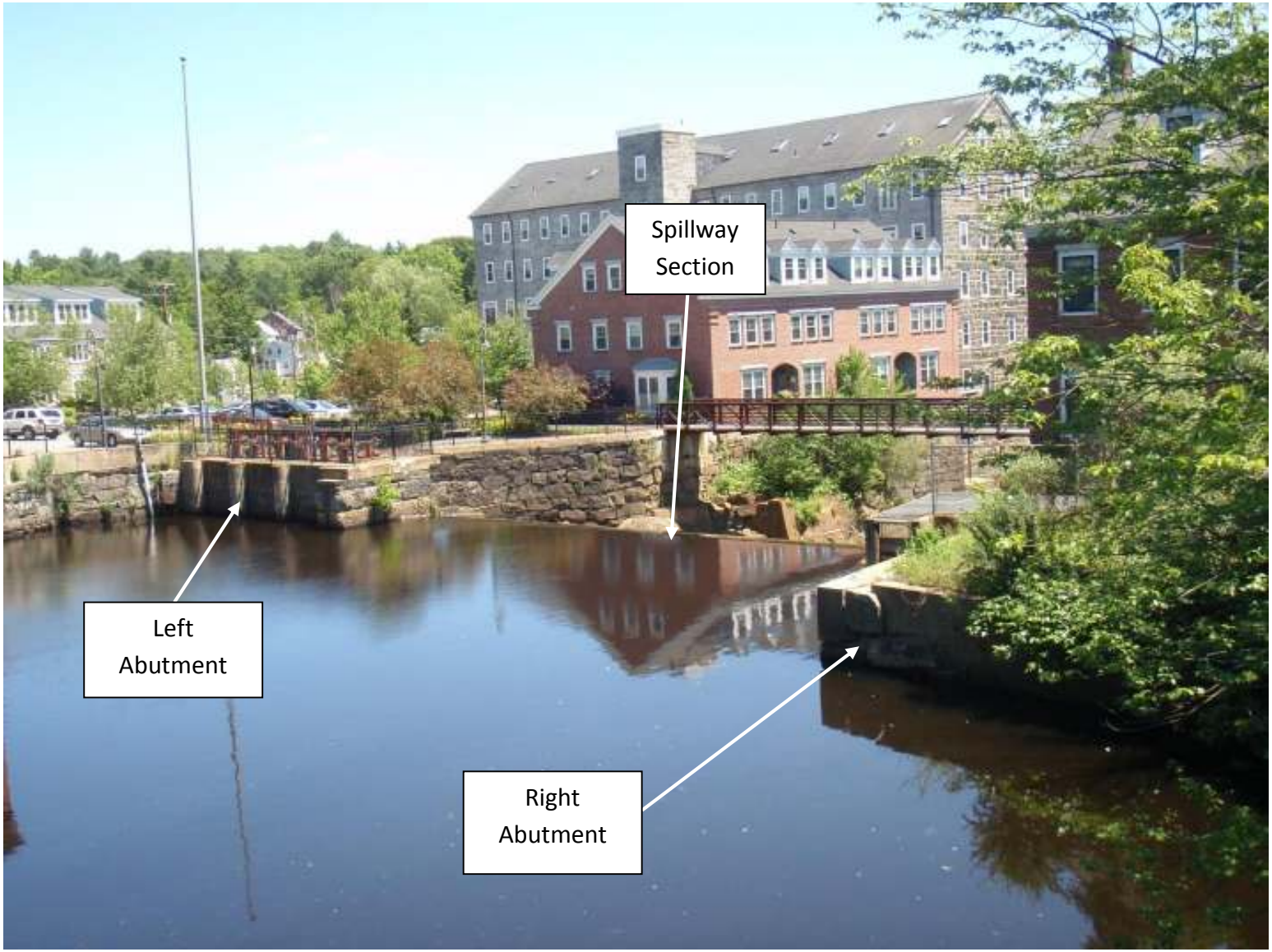

Figure 4: Looking downstream toward Macallen Dam's left abutment, right abutment and spillway sections. Photo taken July 2012.

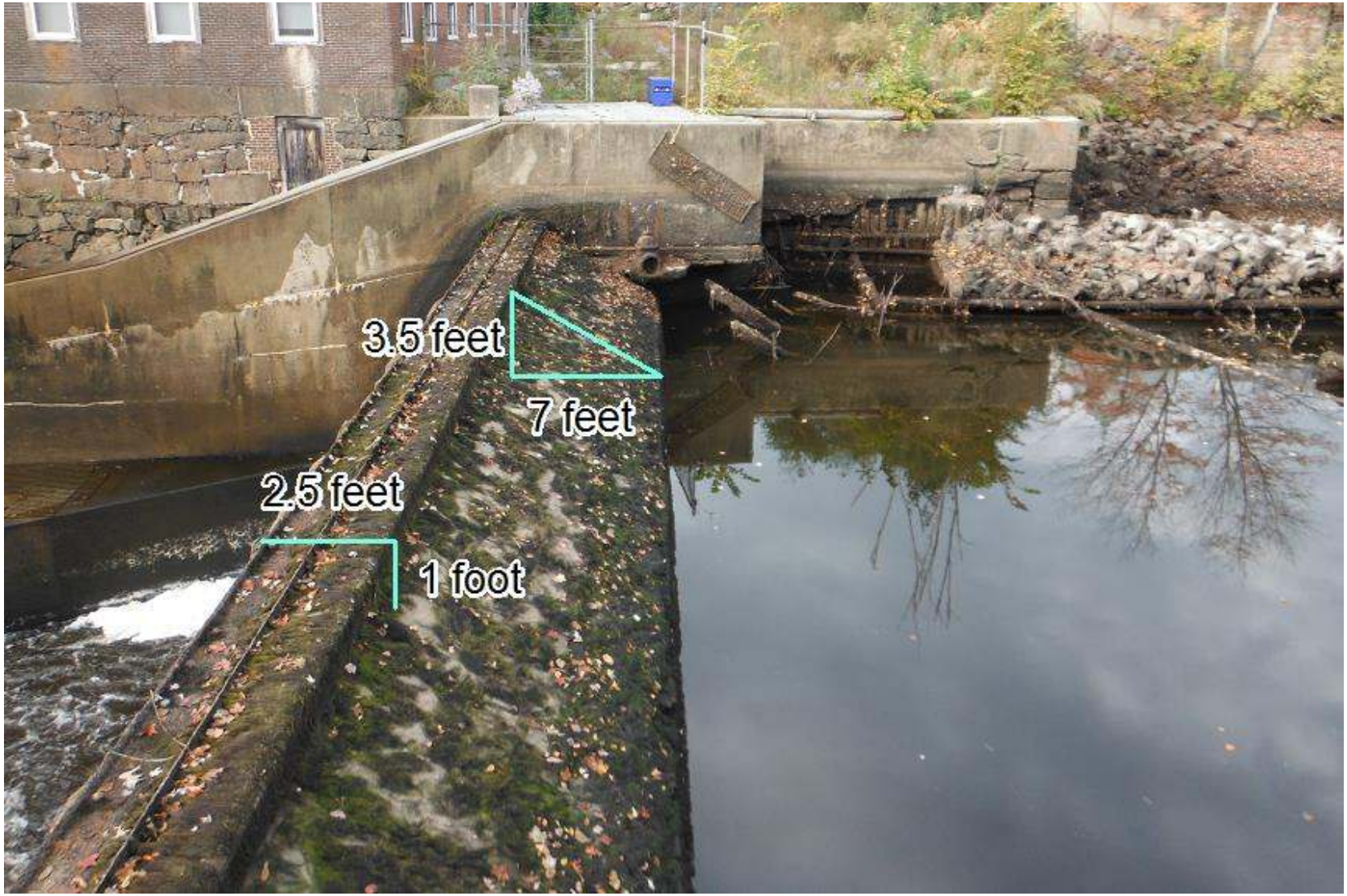

Figure 5: Photo of the dam's right abutment and spillway sections, including geometry of the sloped upstream face of the dam. Photo taken during the October 2013 drawdown. Note the metal lip running along the center of the spillway crest.

Figure 6:Left abutment and crest gates. Photo taken during the October 2013 drawdown.

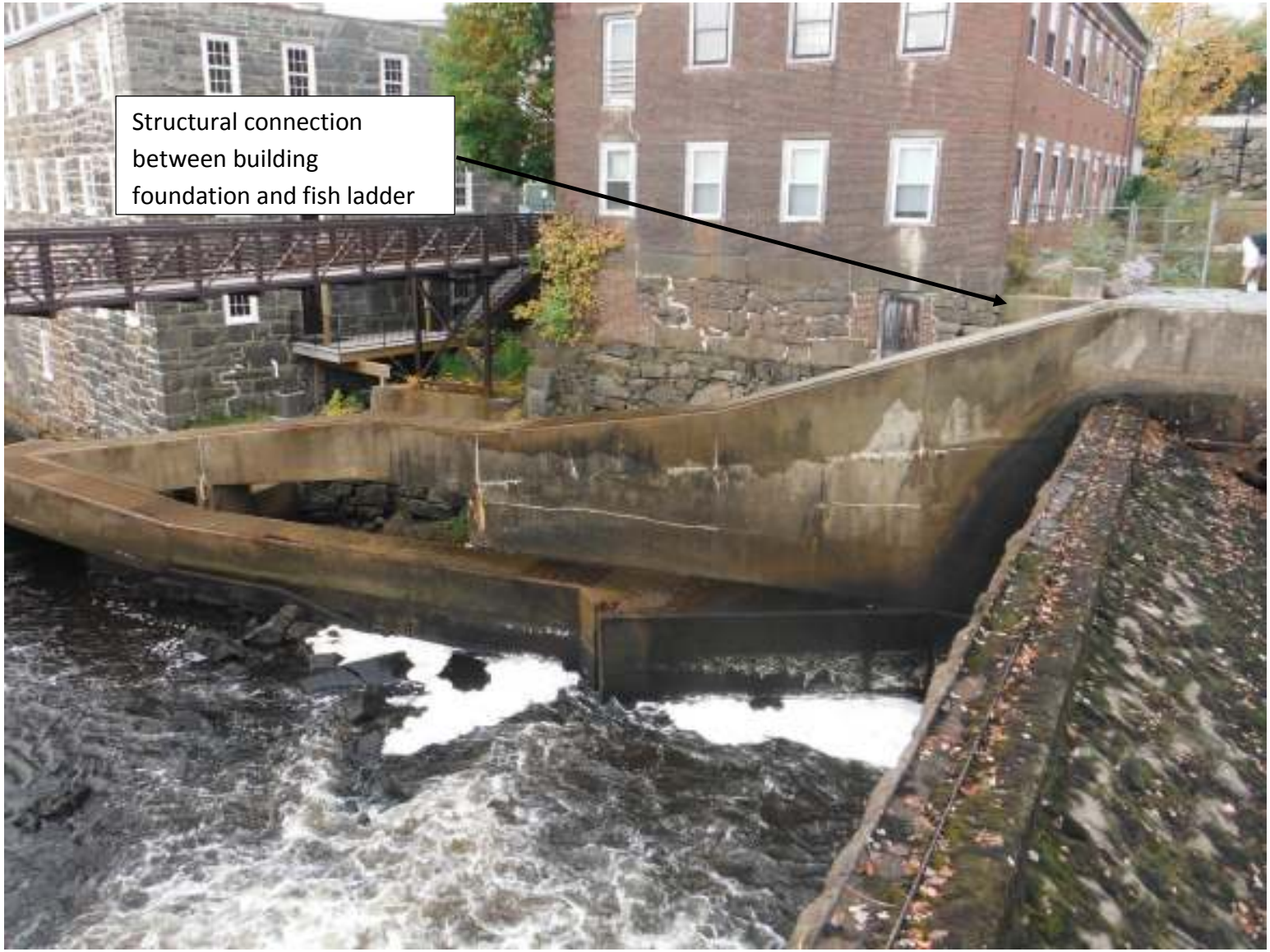

Figure 7: Photograph of the right abutment showing the connection between the fish ladder and the building on the right abutment.

Figure 8: Macallen Dam during the March 16, 2010 flood event. Flow is approximately 6,710 cfs. Photo is taken from the right abutment, looking toward the spillway and left abutment. Photo source: NHDES Dam Bureau.

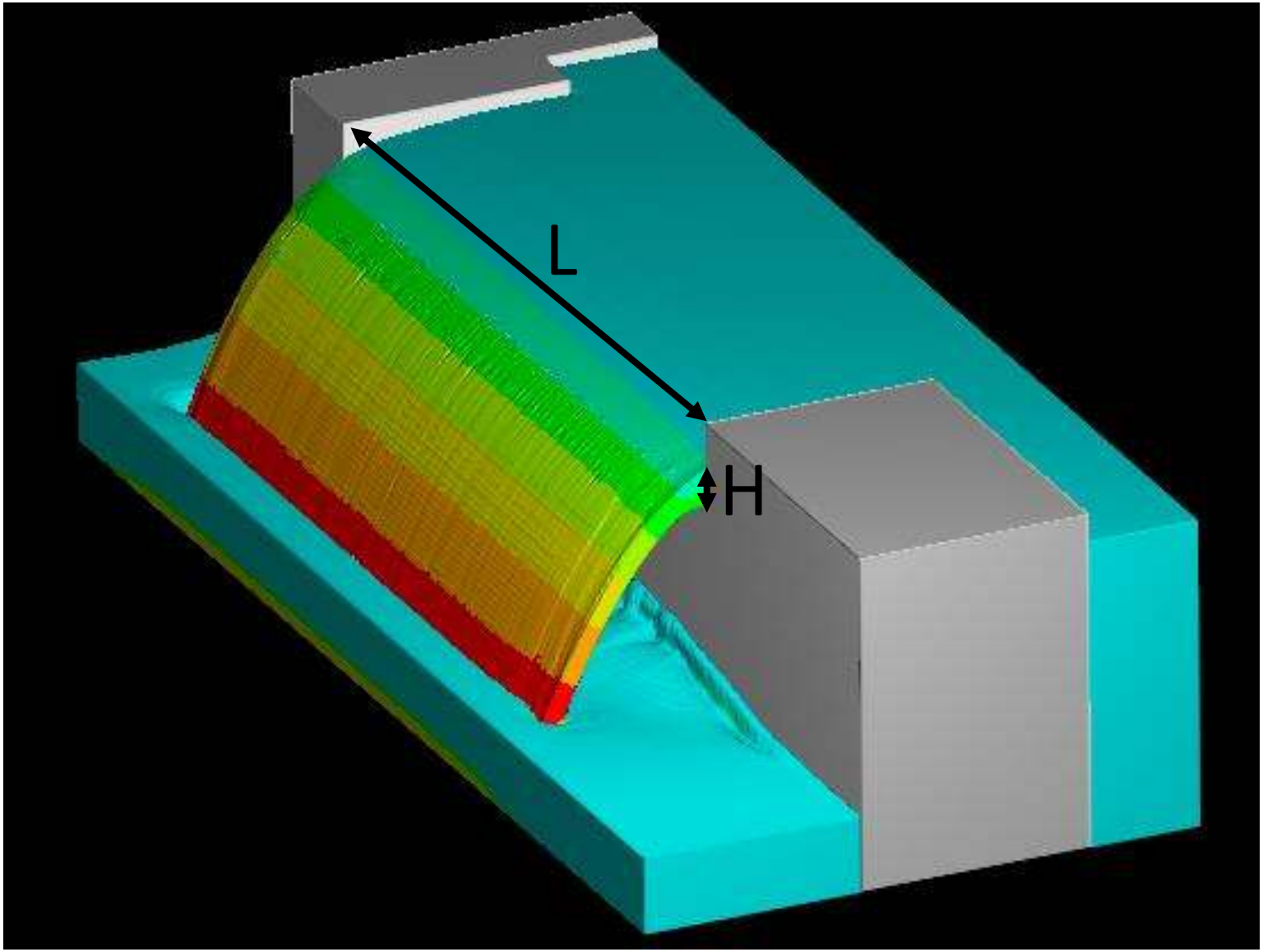

Figure 9: Three-dimensional representation of a broad-crested weir.

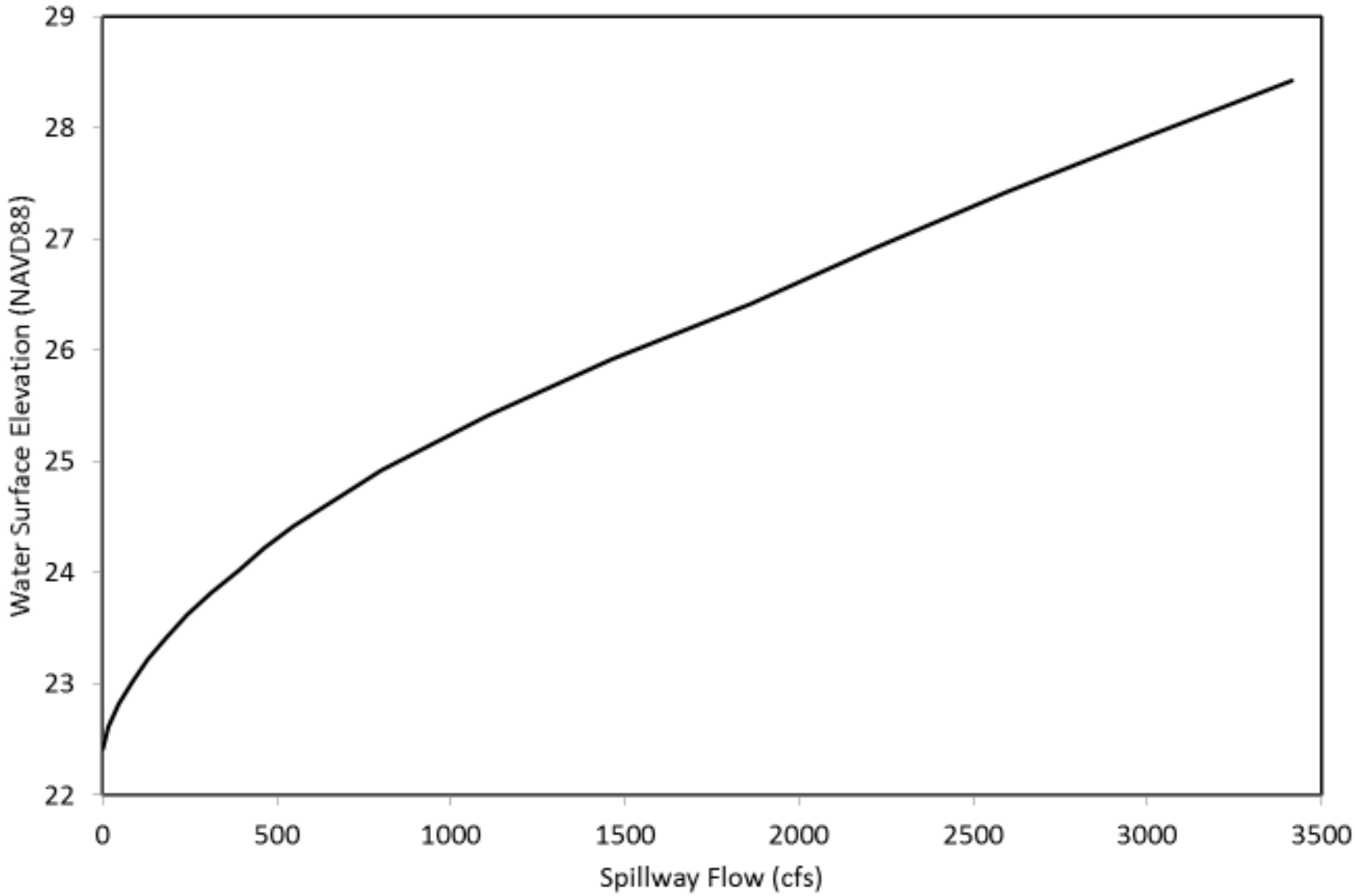

Figure 10: Macallen Dam spillway elevation versus flow rating curve. The spillway crest is at elevation 22.42 feet.

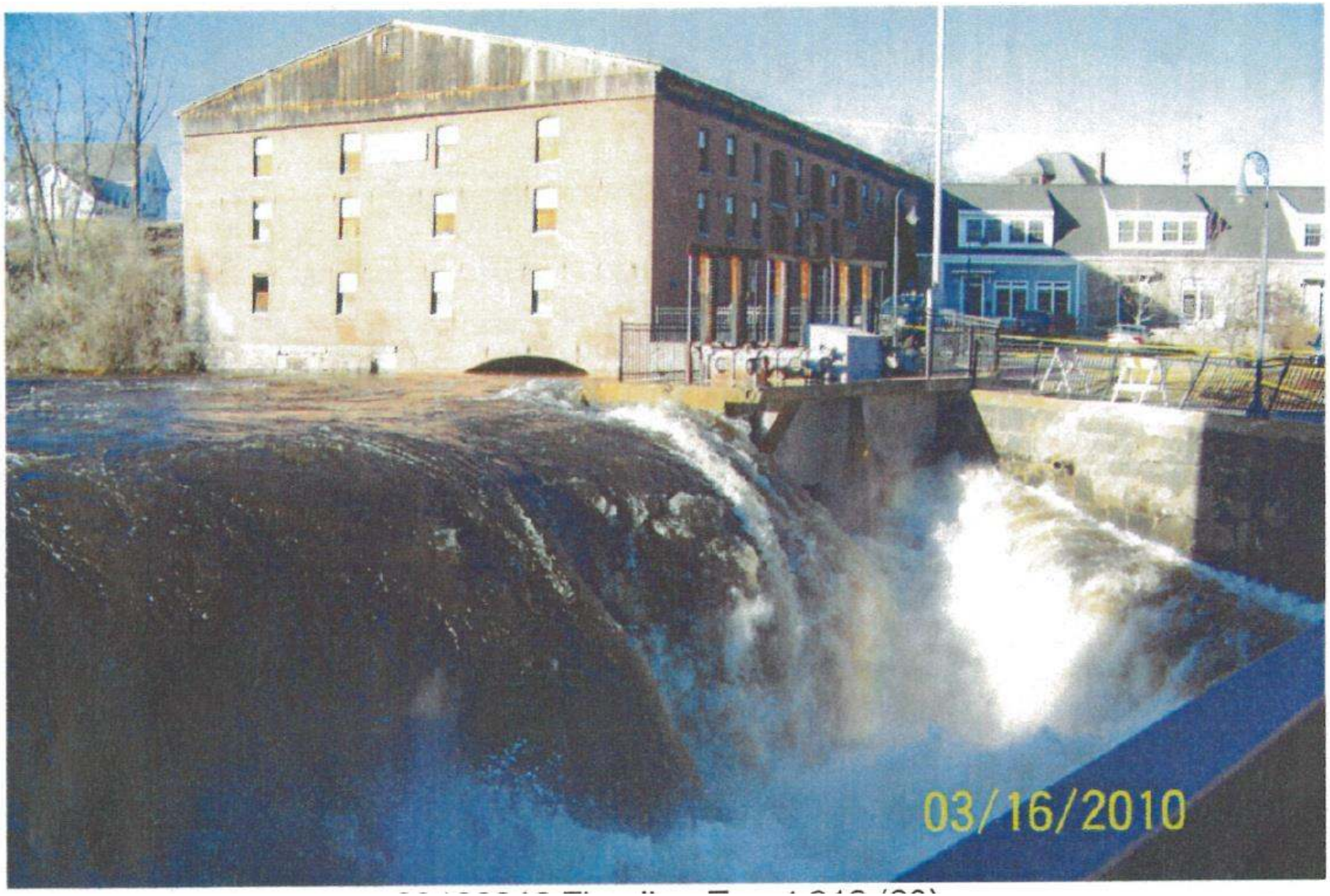

Figure 11: Looking upstream at the Macallen Dam spillway and left abutment during the March 2010 flood. Flow is approximately 6,710 cfs. Note backwater downstream of the gate structure due to the angled wall on river left. Photo source: NHDES Dam Bureau.

Figure 12: Macallen Dam crest gates elevation versus flow rating curve. Flows below the spillway crest elevation were not calculated. Calculations assume all three gates are fully open.

Figure 13: Macallen Dam water surface elevation versus flow for the gate, spillway and total dam flow.

Regulatory Oversight and Letter of Deficiency

The New Hampshire Department of Environmental Services (NHDES) Dam Bureau is responsible for dam oversight in New Hampshire. NHDES classifies dams as Class AA, Class A, Class B, or Class C. The hazard classification is based on a dam's size (height), volume of impounded water and the potential loss of life, structures, and property if dam failure were to occur. The Macallen Dam is classified as a Class C structure (i.e., high hazard dam). A high hazard classification means that loss of life is likely to occur if the dam were to fail. NHDES regulations (Env-Wr 101.09) state that:

"Class C Structure means a dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in probable loss of human life as a result of:

- *(a) Water levels and velocities causing the structural failure of a foundation of a habitable residential structure or a commercial or industrial structure which is occupied under normal conditions;*
- *(b) Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure which is occupied under normal conditions when the rise due to dam failure is greater than one foot;*
- *(c) Structural damage to an interstate highway which could render the roadway impassable or otherwise interrupt public safety services;*
- *(d) The release of a quantity and concentration of materials which qualify as "hazardous waste" as defined by RSA 471-A:2 VI; or*
- *(e) Any other circumstance which would more likely than not cause one or more deaths."*

As stated in the 2010 Letter of Deficiency (LOD) issued by the NHDES to the Town, the Macallen Dam is classified as a high hazard dam because the dam's right abutment is integral to the foundation of the historic brick mill building (current proprietor, Durham Book Exchange) on river right. The state's concern is that if the dam were to breach or overtop, its failure could impact the foundation of the historic brick mill building. This building is a commercial structure that is occupied under normal conditions[7], as described in term (a) above.

NHDES requires that each dam classification must pass a specific discharge capacity, which means "*the amount of water which can safely pass the structure through its normal discharge channels*" (Env-Wr 101.16).

NHDES regulations (Env-Wr 303.11) state the following relative to discharge capacity:

[7] Past inspections (prior to 2010) did not take this building into account because it was previously uninhabited.

(a) All Class A, Class B, or Class C dams constructed prior to February 19, 1981 shall pass the flows indicated below with one foot of freeboard and without manual operations:

(1) Class A dams shall pass a 50-year flood, or at the owner's option, the site specific inflow design flood;

(2) Class B dams shall pass the 100-year flood, or at the owner's option, the site specific inflow design flood; and

(3) Class C dams shall pass 250% of the 100-year flood, or at the owner's option, the site specific inflow design flood.

As a Class C dam, the Macallen Dam must pass 250% of the 100-year flood, or at the owner's option, the site specific inflow design flood (IDF)[8]. Wright-Pierce conducted a detailed study and concluded that the IDF is equivalent to the 100-year flood at the Macallen Dam. This effectively means that for flows above the 100-year flood, failure of the dam is not anticipated to cause any additional loss of life or property beyond what would already have occurred from a flood of that size. The Macallen Dam's 100-year flood flow is 10,259 cfs after taking the Lamprey-Oyster "flow split" into account[9]. It is also worth noting that the dam's previous classification as a Class B dam (i.e., significant hazard dam) prior to 2008 would still require passage of the 100-year flood or the IDF. Since the IDF is being used as the design flood, and it is the same as the 100-year flood, the dam's discharge capacity requirement would not change even if the dam was considered a significant hazard dam rather than a high hazard dam.

The "one foot of freeboard" requirement means that the water depth over the dam spillway under the 100-year flood must be at least one foot below the lowest abutment. For the Macallen Dam, the right abutment (elevation 28.47 feet) is the lower abutment. This means that the 100-year flood flow must pass with a water surface elevation of 27.47 feet or less at the dam.

The term "without manual operations" is not explicitly defined in the dam safety regulations. Based on our experience with NHDES Dam Safety, this means that any structure requiring human intervention is considered manual operations. For example, the three gates at the dam's left abutment require a human to either physically or electrically open the gates. Thus, these gates are not counted toward the dam's discharge capacity even though the town would normally open them during a flood event.

[8] The IDF is the flow at which dam failure is not anticipated to cause any additional impacts to life or property.

[9] Under extreme floods, the Lamprey River water surface elevations rise high enough to flow over the typical watershed boundary. When this happens some of the Lamprey River's flow diverts into the Oyster River watershed, rather than passing downstream to the Macallen Dam. This phenomena is explained in detail later in this document.

Letter of Deficiency and Study Timeline

NHDES initially sent the Town a LOD for Macallen Dam in May 2008. Since then, there has been a series of follow-up studies, a new LOD in September 2010, and other correspondence between NHDES and the Town. The purpose of this section is to summarize the actions and correspondences that have occurred since the 2008 LOD was issued up through the issuance of the most recent Wright-Pierce letter report dated February 6, 2013.

2008 Hazard Reclassification (April 7, 2008): Based on NHDES's April 7, 2008 Macallen Dam inspection report, the Macallen Dam's hazard classification was changed from a Significant Hazard (Class B) dam to a High Hazard (Class C) dam. The classification change at the time was based on anticipated flooding in downstream apartments in the event of a dam breach. The hazard reclassification increased the dam's required design flow from the 100-year flood or the IDF to 2.5 times the 100-year flood or the IDF. The inspection did not note any signs of habitation in the historic mill building (current proprietor, Durham Book Exchange) that is structurally tied to the right abutment, and that building was thus not considered in the hazard classification as part the 2008 reclassification and LOD.

NHDES 2008 Letter of Deficiency (May 5, 2008): The NHDES sent the Town a LOD on May 5, 2008. This LOD superseded a previously issued LOD from 2004. The 2008 LOD noted that some items from the 2004 LOD were not addressed. The LOD included a timeline for addressing the deficiencies, which included submitting an Operations, Maintenance and Response (OMR) form to NHDES, developing an Emergency Action Plan (EAP) and inundation maps, and various other structural and maintenance-related items. The LOD also indicated that the Town must submit a permit application with plans and specifications to increase the dam's discharge capacity so that it can "safely pass the design flow (2.5 Q100 or IDF) with one foot of freeboard and no operations."

Wright-Pierce Dam Assessment (began in 2009): In 2009, the Town hired Wright-Pierce to conduct an overall assessment of Macallen Dam, including a structural inspection and analysis of the dam, drafting an EAP, dam breach modeling and inundation mapping.

Wright-Pierce Structural Analysis and Recommendations (March 8, 2010): Wright-Pierce's letter report summarized the results of their November 7, 2009 inspection. Several repairs and rehabilitation measures were suggested to be undertaken within two years. The report indicated that Wright-Pierce did not perform a structural or stability analysis of the dam.

Wright-Pierce Structural Repair Cost Estimate (April 1, 2010): The document provided a cost estimate for the repairs and rehabilitation measures indicated in the March 8, 2010 letter. The costs were broken down into two phases, where Phase I repairs were recommended near-term fixes, while Phase II repairs were recommended to be completed concurrent with dam capacity

improvements. The estimates were $215,000 for Phase I and $290,000 for Phase II. The letter report did not include a cost estimate to bring the dam into compliance with the spillway flow capacity requirement.

Wright-Pierce Initial Dam Breach Results (May 24, 2010): Wright-Pierce sent a letter report summarizing the dam breach analysis to Mr. Wojnowski, the Newmarket Town Administrator at the time. The report objectives were to verify the dam's hazard classification and provide initial inundation mapping for use in the EAP. The dam breach analysis was conducted for a 100-year flood flow of 8,302 cfs and a "Sunny Day" flow of 272 cfs. The 100-year flow used in the analysis was cited as the same flow indicated in the April 2007 inspection report.

The report indicated that neither the downstream apartments nor any other habitable structure would be impacted by the dam breach. Thus, Wright-Pierce concluded that the dam should be reclassified as a significant hazard dam. The Town sent NHDES a reclassification request letter on June 7, 2010 asking to change the dam's classification from high hazard to significant hazard.

NHDES Review of Initial Dam Breach Results (September 8, 2010): NHDES provided comments to the Town on the initial dam breach results and the hazard reclassification request.

The letter noted that the historic mill building (current proprietor, Durham Book Exchange) abutting the dam's right abutment appeared to be habited, and that a failure of the dam may impact the building's foundation. Thus, regardless of potential impacts to the downstream apartments, it was necessary to maintain the dam's high hazard classification.

Other key points from the letter included:

1) The 100-year inflow used in the initial report (cited in the 2007 inspection report) dated back to a February 1999 inspection report. The 100-year flood flow was determined by using the United States Geological Survey (USGS) streamflow gage (Gage No. 01073500) located on the Lamprey River at Packers Falls and adjusting the 100-year flood, based on drainage area, to the Macallen Dam. NHDES recommended developing a new 100-year inflow for the Macallen Dam impoundment.
2) NHDES suggested conducting an IDF analysis, which may result in a lower design flood than 2.5 times the 100-year flood. Because the high hazard classification is solely due to the historic mill building next to the right abutment, the IDF may be as low as a 100-year flood event.

NHDES 2010 LOD (September 27, 2010): NHDES issued a new LOD. The LOD included a timeline for addressing the deficiencies, which included submitting an OMR form to NHDES, developing an EAP and inundation maps, and various other structural and maintenance-related items. The

LOD also indicated that the Town must submit a permit application with plans and specifications to increase the dam's discharge capacity so that it can "safely pass the design flow (2.5 Q100 or IDF) with one foot of freeboard and no operations" by September 1, 2012. On January 2, 2011, the Town responded to the LOD and signed a form agreeing to address the deficiencies.

Wright-Pierce Final Dam Breach Results (February 6, 2013): Wright-Pierce revisited the initial dam breach analysis based on comments received by NHDES. There was a series of communications between Wright-Pierce and NHDES concerning the hydrology and hydraulics components of the dam breach analysis. The hydrology discussions focused on the rainfall-runoff analysis[10] for the Lamprey River watershed. The hydraulics discussions focused on the Lamprey River/Oyster River "flow split". Ultimately, the Town and NHDES agreed on a 100-year flood flow (which is also the IDF) at the Macallen Dam of 10,259 cfs.

The letter report resulting from this analysis was sent to the Town on February 6, 2013. In addition to describing the final inundation maps and modeling results, the report included a cost estimate for bringing the Macallen Dam into compliance. The costs were broken down into dam repairs costs from the April 2010 letter and dam modification costs necessary to meet the spillway flow capacity requirements.

The report included several potential dam modification scenarios. The modification scenarios included permanently lowering the dam spillway, widening the spillway, raising the dam abutments, or combinations of all three options. Due to site constraints, Wright-Pierce considered any scenario that required widening the spillway crest length beyond 140 feet (currently 70 feet wide) to be infeasible. The report listed five modification scenarios as potentially feasible. The dam modification cost estimates were based on unit (i.e., per unit width or per unit height) costs from other dam removal study estimates; site specific cost estimates were not developed. The costs include $234,000 for the Phase I structural repairs recommended in April 2010, but do not include any potential costs associated with modifying the fish ladder. An itemized cost estimate was not provided in the study report. Table 1 summarizes the spillway improvement alternatives that Wright-Pierce deemed potentially feasible.

[10] NHDES required that a rainfall-runoff analysis be conducted to estimate the 100-year flood flow, rather than relying on the Lamprey River USGS gage.

Table 1: Potentially feasible dam spillway alternatives from February 2013 Wright-Pierce report.

Alternative	Description	Crest Elevation (feet)	Crest Length (feet)	Estimated Cost
Existing	Existing conditions – NOT FEASIBLE, included for comparison purposes	22.18	70	-
2	Lower spillway crest	12.59	70	$1,100,000
3	Increase crest length, lower crest elevation	17.30	140	$2,900,000
5	Raise right (west) abutment 1.8 feet, lower crest elevation	14.39	70	$1,300,000
6	Raise right abutment 1.8 feet, lower crest elevation, increase crest length	19.10	140	$3,000,000
7	Raise right abutment 1.8 feet, lower crest elevation, increase crest elevation, add 3 foot tall crest gate	22.18	140	$4,600,000

Only two of the potential spillway alternatives do not require widening the dam spillway. These scenarios, Alternatives 2 and 5, permanently lower the dam crest by 7.8 feet to 9.6 feet, respectively. Lowering the impoundment will reduce water depths throughout the impounded portion of the Lamprey River. Shallow backwater areas may be permanently dewatered if the dam crest is lowered. For reference, water levels dropped approximately 6.6[11] feet during the fall 2013 drawdown.

Impoundment Hydrology

Flow Data

Figure 14 is a map of the Lamprey River watershed. As noted above, a USGS gage (No. 01073500) is located upstream of the impoundment near Packers Falls that continuously measures flow data. The drainage area at the Packers Falls gage is approximately 183 mi^2. The Lamprey River at the Macallen Dam has a drainage area of approximately 212 mi^2, an increase of approximately 16%. Most of the incremental drainage area between the USGS gage and the Macallen Dam is due to the Piscassic River (drainage area = 23 mi^2), a major tributary to the Lamprey. The Piscassic River has no USGS gage. To estimate Macallen Dam flows, flows from the Packers Falls USGS gage were prorated by a ratio of drainage area (212/183) to represent

[11] This is greater than the maximum drawdown listed above because the pre-drawdown water level was several inches above the spillway crest.

flow at Macallen Dam. An annual flow duration curve[12] for the Macallen Dam is shown in Figure 15, and monthly flow duration percentiles are shown in Table 2.

Lamprey-Oyster Flow Split

During high flows, water levels in the Macallen Dam impoundment rise considerably. When water levels rise several feet above normal conditions, some of the water backwaters into the Moat Island area (Figure 1) and diverts flow over Route 108 and Longmarsh Road in Durham. This water leaves the Lamprey River watershed and passes into Longmarsh Brook, then Hamel Brook, and finally the Oyster River and over the Oyster River Dam[13]. This diversion reduces the amount of water passing over the Macallen Dam during extreme flood events. Various studies have estimated the portion of this flow that is diverted. The most recent studies looking at the Lamprey-Oyster flow split are the Wright-Pierce February 2013 study and the UNH Lamprey River study[14]. Most recently, the Wright-Pierce February 2013 study estimated the magnitude of flow diversion during a 100-year flood event was approximately 4,261 cfs of the 14,520 cfs flowing into the Macallen Dam impoundment, leaving 10,259 cfs to flow toward the Macallen Dam.

The proportion of water diverted from the Lamprey River into the Oyster River watershed during a flood is a function of the water surface elevation at the Moat Island flow split. Altering the hydraulic controls in either flow path (main stem Lamprey River or the flow diversion path) will change the amount of water that remains in the Lamprey River. Raising the hydraulic controls (and consequently water surface elevations) in the main stem Lamprey River will increase the diversion proportion, while lowering the water surface elevation (such as removing or lowering the Macallen Dam) will decrease the diversion proportion. Similarly, raising the hydraulic controls (and consequently water surface elevations) in the flow diversion reach will reduce the amount of flow diverted to the Oyster River and increase the proportion passing over the Macallen Dam.

This phenomena will be important for the Town to consider in any final hydraulic designs, as lowering the Macallen Dam may decrease the proportion of flow diverted into the Oyster River during flood events. This essentially creates a “moving target,” such that as the dam is lowered, it will have to pass more flow in order to meet the freeboard requirement. The Wright-Pierce

[12] Flow duration curves plot the percentage of time a given flow is equaled or exceeded based on a certain period of record.
[13] The Oyster River Dam currently has an LOD for spillway deficiency. The dam’s estimated 100-year flood flow is 1,688 cfs. The drainage area at the dam is approximately 20 mi^2.
[14] The document describing this work is a Thesis titled “Consequences of Changing Climate and Land Use to 100-Year Flooding in the Lamprey River Watershed of New Hampshire” by Ann M. Scholz in December 2011.

hydraulic calculations and cost-estimates do not appear to take this factor into account in their spillway alternatives.

Table 2: Lamprey River annual and monthly flow duration curves. Flows are drainage-area prorated from USGS gage No. 01073500 daily average flows. Period of record 10/1/1935-9/30/2011.

Percentile	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	9,324	3,252	5,262	7,339	8,654	9,324	5,052	3,642	2,517	3,372	7,416	2,203	2,719
5	1,119	921	1,024	2,001	1,989	1,018	682	357	262	279	521	927	1,128
10	788	659	732	1,451	1,557	784	484	231	180	166	350	693	838
15	624	541	571	1,172	1,324	678	386	184	137	122	266	563	675
20	512	463	488	1,015	1,123	595	314	151	115	95	213	488	593
25	426	402	431	903	996	523	269	127	97	80	182	420	522
30	360	359	377	825	886	464	230	111	83	68	149	371	465
35	309	323	337	739	790	417	200	96	73	58	129	324	407
40	268	295	306	667	729	380	176	83	62	50	113	286	360
45	230	269	279	601	670	352	159	73	52	43	100	254	325
50	199	244	253	545	622	325	139	64	43	37	87	221	293
55	169	227	232	489	569	299	125	57	36	31	78	196	265
60	141	210	216	434	520	278	112	49	31	25	68	169	237
65	116	191	200	383	477	253	99	43	27	22	56	144	212
70	93	174	181	338	438	230	86	36	23	19	46	123	190
75	74	152	165	303	390	208	76	31	20	16	36	100	164
80	57	133	151	272	355	188	69	28	18	14	28	86	140
85	42	114	126	238	316	160	60	24	15	12	22	71	116
90	27	86	102	203	270	131	50	20	12	10	16	57	79
95	16	55	71	159	217	101	39	15	9	7	11	42	58
100	2	28	36	45	103	52	12	2	2	2	3	10	12
Median	199	244	253	545	622	325	139	64	43	37	87	221	293
Average	340	334	363	732	817	431	239	113	87	83	164	320	399

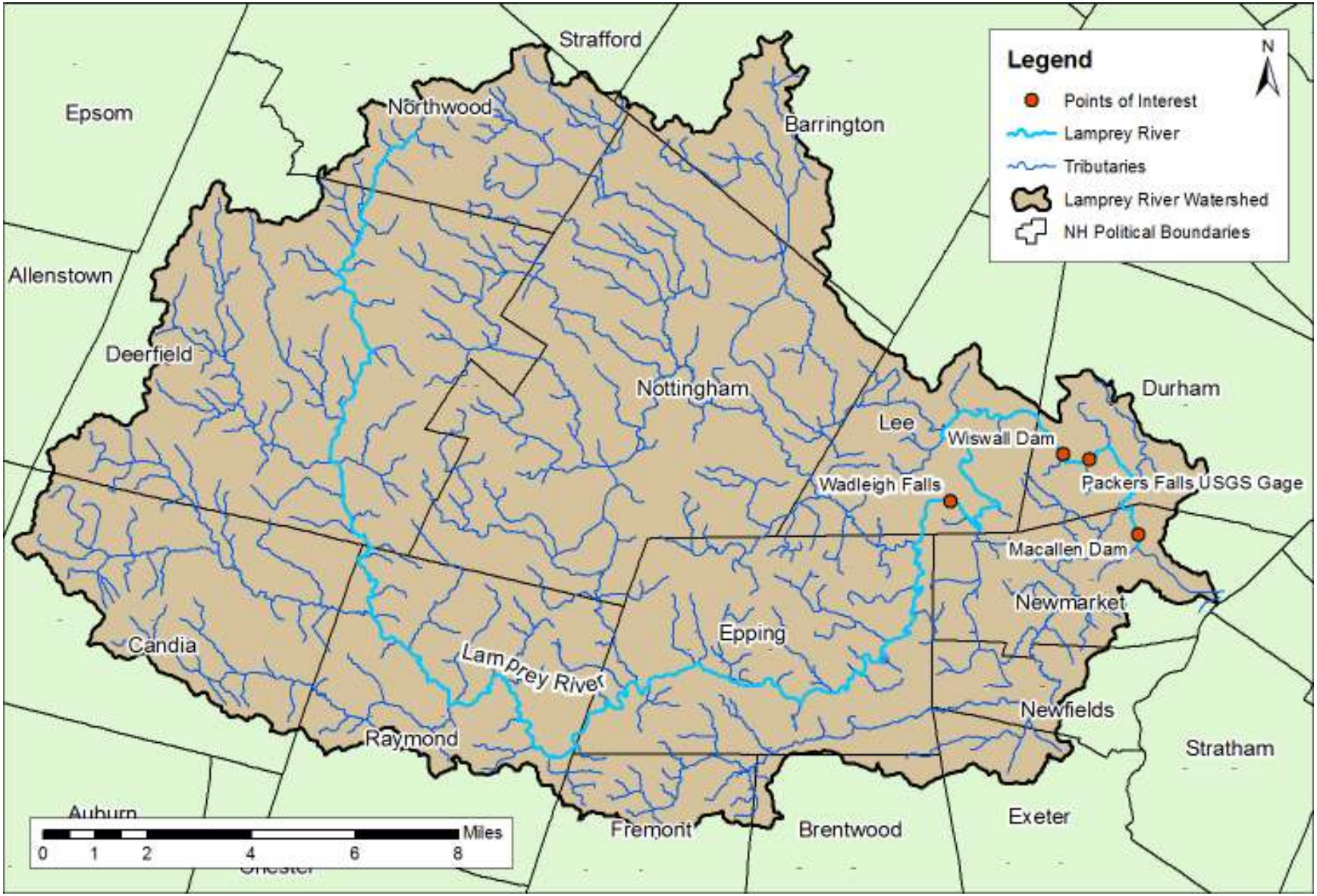

Figure 14: Lamprey river watershed; and points of interest.

Figure 15: Lamprey River at Macallen Dam flow duration curve. Flows are drainage-area prorated from USGS gage No. 01073500 daily average flows. Period of record 10/1/1935-9/30/2011.

Existing Information

Contaminated Sediment Potential

We researched websites (NHDES One-Stop, EPA Superfund, Remediation Sites, Hazardous Waste Generators, NPDES outfalls, etc.) to determine what, if any, spills or sources of contamination may be present in the project area. The 2012 draft 303(d) list shows that Polyaromatic Hydrocarbons (PAHs) and other chemical impairments are present immediately below the dam. Table 3 lists the impairments for each segment mapped in Figure 16. A summary of the NHDES One-Stop results in the immediate vicinity of the impoundment are in Table 4. Figure 17 is a map of the NHDES One-Stop locations listed in Table 4.

Table 3: Water quality impairments in the NH DES 2012 draft 303(d) list.

NH DES Assessment Unit ID	Assessment Unit Name	Use Description	Impairment Name
NH EST 600030709-01-01	Lamprey River North	Aquatic Life	2-Methylnaphthalene, Acenaphthylene, Aluminum, Anthracene, Arsenic, Benzo(a)pyrene (PAHs), Benzo(a)pyrene (PAHs), Benzo[a]anthracene, Benzo[a]anthracene, Cadmium, Chlorophyll-a, Chrysene (C1-C4), Chrysene (C1-C4), Copper, DDD, DDE, DDT, Dibenz[a,h]anthracene, Dibenz[a,h]anthracene, Dissolved oxygen saturation, Fluoranthene, Fluoranthene, Fluorene, Lead, Mercury, Naphthalene, Nickel, Nitrogen (Total), Dissolved Oxygen, Phenanthrene, Pyrene, pH, trans-Nonachlor
NH EST 600030709-01-01	Lamprey River North	Fish Consumption	Polychlorinated biphenyls
NH EST 600030709-01-01	Lamprey River North	Primary Contact Recreation	Chlorophyll-a, Nitrogen (Total)
NH EST 600030709-01-01	Lamprey River North	Shellfishing	Dioxin (including 2,3,7,8-TCDD), Polychlorinated biphenyls
NH EST 600030709-01-02	Lamprey River South	Aquatic Life	Chlorophyll-a, Estuarine Bioassessments, Light Attenuation Coefficient, Nitrogen (Total)
NH EST 600030709-01-02	Lamprey River South	Fish Consumption	Polychlorinated biphenyls
NH EST 600030709-01-02	Lamprey River South	Primary Contact Recreation	Chlorophyll-a, Nitrogen (Total)
NH EST 600030709-01-02	Lamprey River South	Shellfishing	Dioxin (including 2,3,7,8-TCDD), Polychlorinated biphenyls
NH IMP 60030708-03	Piscassic River	Aquatic Life	Dissolved oxygen, Dissolved oxygen saturation, pH
NH IMP 60030709-03	Lamprey River - Macallen Dam Impoundment	Aquatic Life	pH
NH RIV 60030708-07	Piscassic River, PWS, CLS-A	Aquatic Life	Dissolved Oxygen, pH
NH RIV 60030709-09	Lamprey River	Aquatic Life	pH

Table 4: Summary of NHDES One-Stop listed sites near the Macallen Dam impoundment.

Master ID	Status	Description
40773	Inactive	Carlisle Construction, hazardous waste generation, ceased in 2004
66991	Closed	Wojnowski Residence, petroleum remediation in 2012 (#2 fuel oil release)
57418	Closed	Cyr residence, 2 teaspoons of #2 fuel oil release from storage tank
61521	Closed	Duplex, Fuel oil released during flooding event
40780	Inactive	Durham Newmarket Animal Hospital, hazardous waste generation (x-ray solution)
43909	Inactive	KB&M Excavating, hazardous waste generation
43901	Inactive	Lamprey River Screen Print, hazardous waste generation (photo silver solution)
43902	Inactive	Great Bay Dental Care, Hazardous Waste Generation (silver)
4362	Closed	Lamprey River Bowling Lanes, leaking underground storage tank, hazardous waste generator, remediation
61653	Closed	Huntington property
60069	Closed	Labone residence, petroleum discharge 2005
51029	Closed	Nichols Ave residence, spill/release
17253	Closed	NHFG site remediation, closed 1991
17258	Closed	PSNH substation, closed 2005
17261	Closed	Marquis residence, petroleum discharge 2001
4363	Active	Jays Newmarket Convenience, site remediation, vapor recovery
54332	Closed	Dover Sugar House, #2 fuel oil release

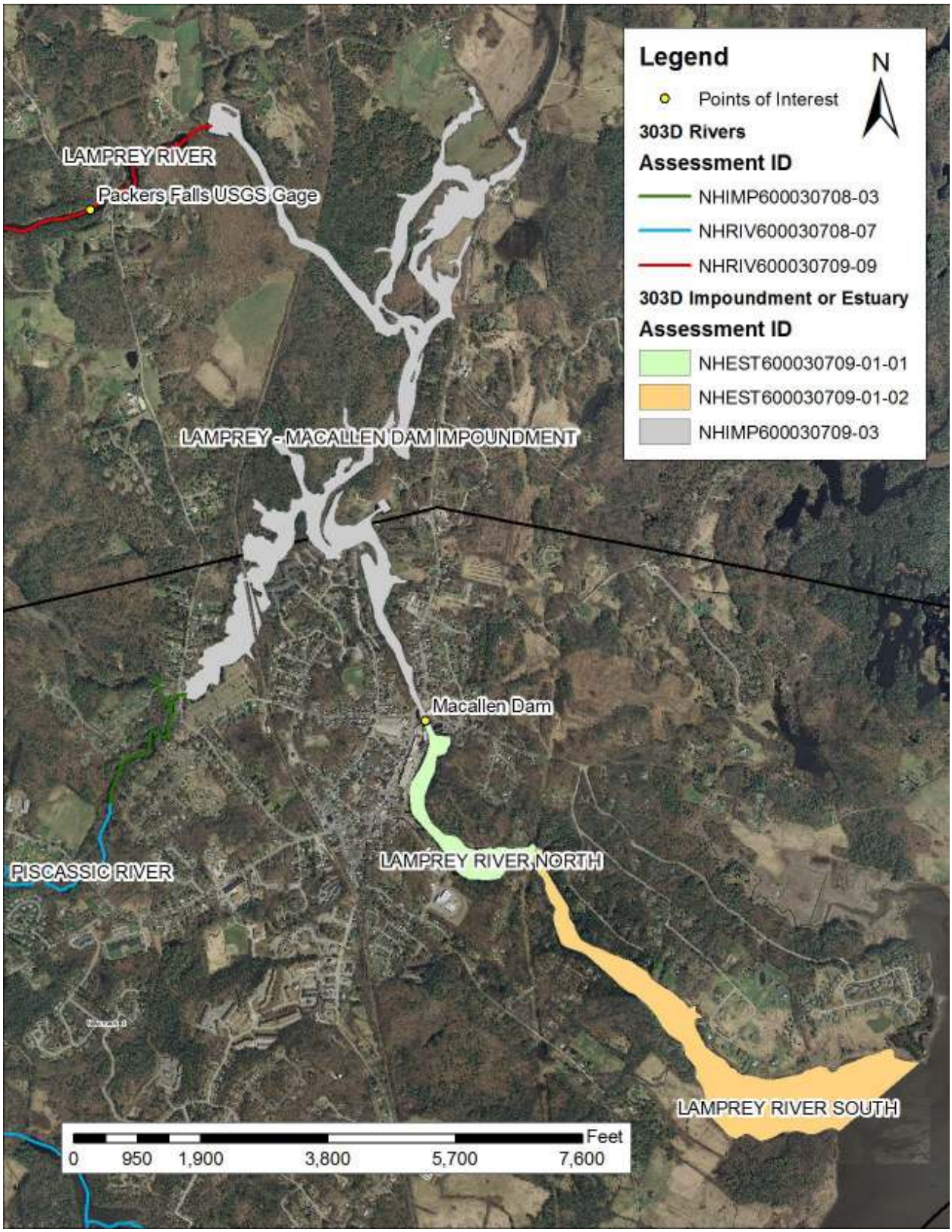

Figure 16: NH 2012 303(d) assessment segments.

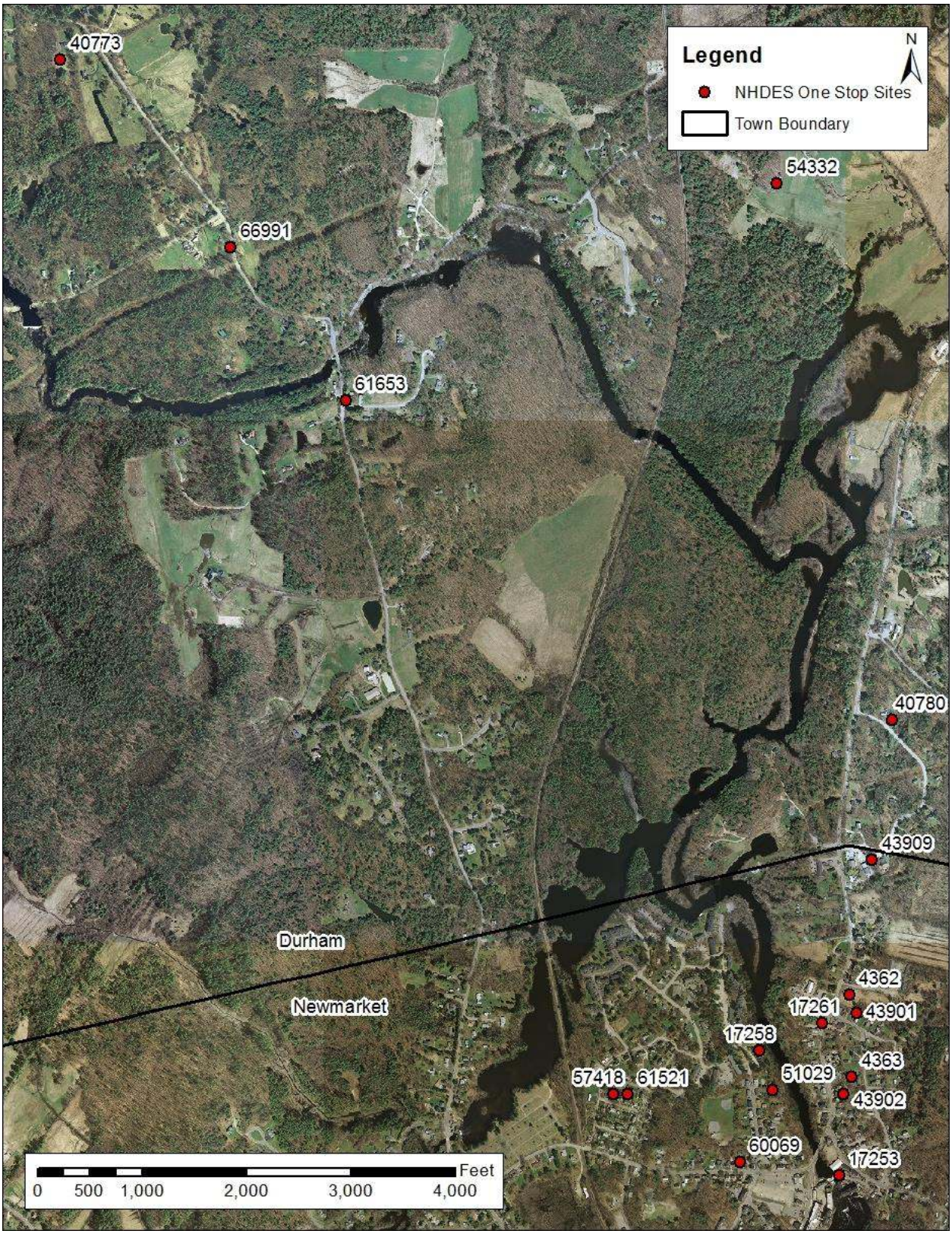

Figure 17: Location map of NHDES OneStop sites near the Macallen Dam impoundment.

Migratory Fish Passage Estimates

The Macallen Dam Denil fish ladder is owned and operated by the NHFGD, and began operation in 1972. The NHFGD annually monitors diadromous and resident fish passing through the fish ladder. The most prominent fish species enumerated are river herring[15] migrating upstream through the ladder to reach spawning habitat from April through June. Passage of other species has also been tracked approximately since 1980. The Macallen Dam fish ladder passage numbers were provided by the NHFGD (NHFGD, unpublished data[16]). The number of fish passed each year varies greatly, but recent years have seen all-time high passage numbers for river herring. Figure 18 shows the number of river herring passed at the Macallen Dam fish ladder, by year, since 1972. The NHFGD estimates indicate approximately 1,400,000 river herring have passed through the Macallen Dam fish ladder since it was first opened in 1972. The NHFGD has documented several species other than river herring also passing through the ladder. These species include Atlantic salmon, sea lamprey, American shad, American eel and various trout, sunfish and perch species, among others.

Efficiency studies have not been completed for the Macallen Dam fish ladder. However, some generalities about passage efficiency at the dam can be made (Personal Communication, C. Patterson, NHFGD, 1/15/2014). These generalities include:

1) The Macallen Dam Denil fish ladder is a 3-foot wide design. This is appropriate for many species such as river herring, but is not for some other migratory fish. For example, American shad prefer a wider (4' or greater) structure even though some may use a 3' Denil fish ladder. Other species, however, such as sturgeon, cannot pass through this type of ladder or most fish ladder designs.
2) Young-of-the-year American eels cannot effectively navigate an operating fish ladder because the water velocities inside the ladder are too high for their swimming ability. Therefore, the existing ladder is likely ineffective for passing this life stage of American eel.
3) Denil fishway entrances are designed to constrict access at the structure entrance to provide attraction flows. Therefore, when large schools of fish arrive at once there can be delayed access to the structure. This delay can therefore create an opportunity for increased predation on the population.

[15] River herring consist of two species: blueback herring and alewife. NHFGD records indicate that the river herring passing through the Macallen Dam fish ladder are almost exclusively alewife. The percentage of blueback herring migrating through the fish ladder has varied between 0% and 12%. However, there is a large blueback herring spawning population below the Macallen Dam that may move upstream under more favorable passage conditions.
[16] Current reports can be found on the NHFGD website:
http://www.wildlife.state.nh.us/marine/marine_div_projects.html

4) Fish ladders are generally seasonally operated to accommodate diadromous fish spawning runs (typically coinciding with higher seasonal flows) and are closed to maintain impoundment levels for the rest of the year. Therefore, the potential for fish to utilize the structure for passage is not year-round. Freshwater fish species that may end up below the dam during high flows may not have the ability to regain access into freshwater when the passage system is closed.
5) Even though a fish ladder is installed to allow freshwater access, native migratory fish populations may still perish due to habitat changes that have occurred within an impoundment or because of successive dams creating many impoundments on a river system. This type of habitat destruction and limited upstream access has eliminated Atlantic salmon from most east coast rivers.
6) The fish ladder at the Macallen Dam provides for upstream migration passage but is not designed for downstream passage.

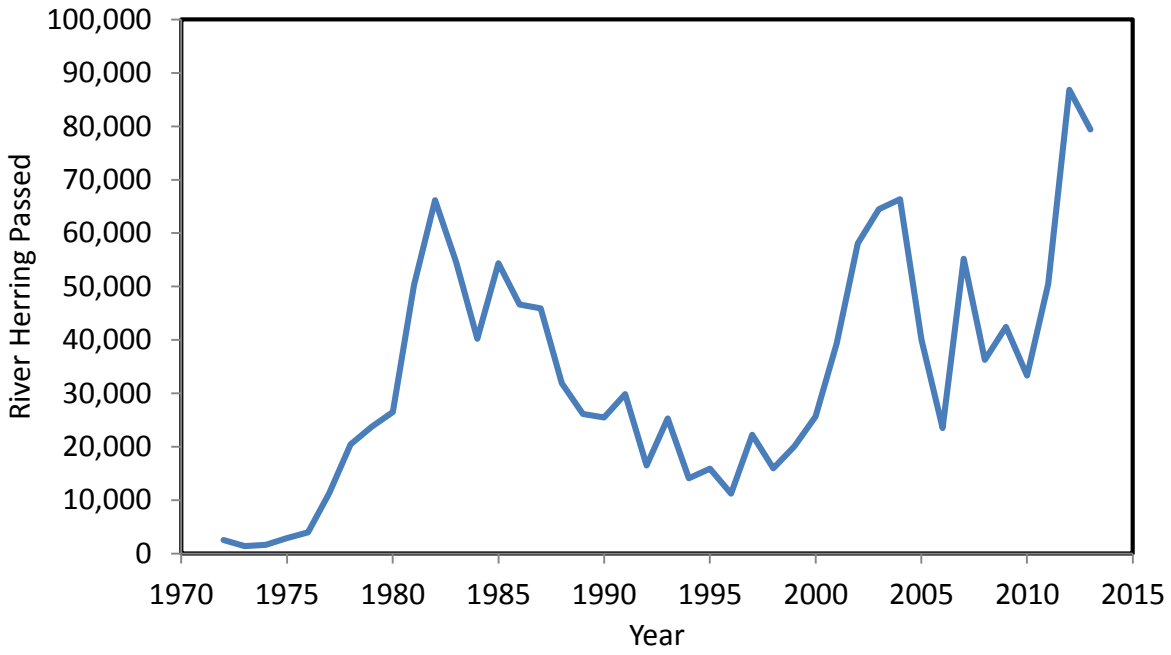

Figure 18: Yearly river herring passed at the Macallen Dam fish ladder. Passage numbers source: NHFG Unpublished Data, provided by C Patterson (NHFGD) on October 30, 2013.

Water Quality Summary

The NH DES 303(d) list indicates several water quality impairments in the Lamprey and Piscassic Rivers in the immediate vicinity of the dam (Table 3). The Lamprey River in the impounded reach is listed as impaired for pH, as is the reach upstream of the impoundment. The Piscassic River upstream of the dam impoundment is listed as deficient for pH and dissolved oxygen and dissolved oxygen saturation. Downstream of the dam, the Lamprey River is deficient for a host

of constituents, including pH and dissolved oxygen. The waters downstream of the dam are also listed as deficient for primary contact due to chlorophyll-a and total nitrogen. The fish consumption and shellfishing designated uses are impaired for PCBs.

Veterans Bridge Information

Veteran's Bridge crosses the Lamprey River approximately 250 feet upstream of the Macallen Dam. The NHDOT provided the most recent bridge inspection report from 2011 with photographs (personal communication, D. Powelson, 6/29/2012). They also provided drawings of the bridge superstructure. NHDOT indicated that they did not have any information on the bridge's substructure (i.e., the stone block abutments/foundation). They indicated that no formal scour calculations had been completed on the bridge, but that screening-level assessments indicated that the bridge was at low risk for scour. NHDOT's 2011 underwater inspection indicated that the river bed around the bridge consists of bedrock with cobbles.

The inspection report indicated that the bridge's clear span is approximately 61 feet. GSE's field survey data confirmed this measurement. While the roadway is skewed relative to the river, the openings are parallel to the river flow direction. Field data from the fall of 2013 drawdown indicate that depths are relatively shallow underneath the bridge relative to reaches upstream and downstream of the bridge. This means that the river bed under the bridge may act as a hydraulic control if the dam were to be lowered or removed. This will be more fully studied as part of the hydraulic modeling that has not been completed.

Rare, Threatened and Endangered Species

A brief review of the New Hampshire National Heritage Bureau records indicated that there are several rare, threatened or endangered species located in Newmarket and Durham. Some of these species may live along or be impacted by changes to the river reach impounded by Macallen Dam. A list of the species, by town, is included in Appendix B.

Hydroelectric Generation

Hydroelectric development is regulated by the Federal Energy Regulatory Commission (FERC). FERC is in charge of issuing operating licenses for hydroelectric developments across the nation. GSE has considerable experience with hydroelectric FERC licensing, having been involved in this practice for 20+ years. We offer the following background information to the Town to help explain the hydroelectric licensing process.

Figure 19: Aerial view of Macallen Dam's former hydroelectric works.

There has been considerable discussion about resurrecting hydroelectric power at the Macallen Dam, which previously generated hydroelectric power until the 1950s. It is our understanding that at one time, there was a 500 kilowatt (KW) turbine on the left side of the river and a 50 KW turbine on the right side. It appears that the intake for the 500 KW turbine was located at the arch at the building located adjacent to the dam, and then conveyed flow via an underground penstock to a turbine located in the basement of a building (Figure 19).

The subject of resurrecting hydropower at the Macallen Dam has been pursued on and off for the past few decades based on filings with the FERC. If an Applicant[17] seeks to develop hydropower at Macallen Dam they must file a preliminary permit application with FERC. If the preliminary permit application is approved by FERC, the Applicant is allowed three years to study the site and file a License Application. The Applicant does not need to file a preliminary permit to study a site's hydropower potential, and screening-level work can be done under the risk of another entity filing a preliminary permit on the site. The Applicant, however, must file a preliminary permit with FERC to formally license the site. FERC has established regulations on

[17] Note that the Applicant can be any party- the Town, non-profit, individual, etc. Potential applicants can file a preliminary permit application on the Macallen Dam at any time. If a municipality (Town of Newmarket) files a competing preliminary permit application at the same time as another party, FERC will grant the preliminary permit application to the municipality due to what is termed "municipal preference".

specifically what must be contained within a preliminary permit application, which includes the following Exhibits:

- Exhibit 1: Project Description- includes a description of the proposed project and its operation.
- Exhibit 2: Study Plans- includes a list of studies proposed by the Applicant.
  Exhibit 3: Statement of Costs and Financing- includes the Applicants estimated study costs and source(s) of financing the project.
- Exhibit 4: Project Maps- includes project maps, and proposed layout of the proposed facility.

Once the preliminary permit is filed with FERC, they review it for completeness (i.e. does the application address the regulatory requirements). FERC will then "notice" the preliminary permit application and seek comment from federal and state agencies, non-government organizations and any interested parties (collectively referred to as stakeholders) on the proposed development. Typically, the comments will include concerns and issues with the potential development. Commonly stakeholders will request various studies to determine the impact of the proposed project on environmental (wetlands, wildlife, plants, fisheries, etc.), geology and soils, water quality, recreation, aesthetic, and cultural resources.

If an Applicant were to pursue a preliminary permit and went through the regulatory process culminating with the filing of a License Application with FERC, there are several milestones required. We have only noted the key milestones below - the full process includes considerably more than is noted below. These steps are described fully in the FERC regulations.

- A Pre-Application Document (PAD) must be filed with FERC describing the proposed project and all of its known environmental, recreation, water quality, recreation, and cultural resources based on research and input from stakeholders.
- Stakeholders will review the PAD and submit letters requesting studies needed to determine the impact of the proposed project on various resources.
- The Applicant must develop study plans addressing the issues and concerns raised by stakeholders.
- Numerous meetings are held with the stakeholders discussing the study plans and revising them, as needed.
- Once agreed upon, the studies are conducted and reports completed.
- Numerous meetings are held to review the various study findings.
- The Applicant files a Draft License Application, obtain comments, and then files a Final License Application.

- Assuming no issues, FERC will issue a License and the NH Department of Environmental Services will issue a 401 Water Quality Certificate. Thereafter, the Applicant can start developing the site.

To our knowledge, preliminary permits were previously filed on the Macallen Dam as follows:

Preliminary Permit Docket No. P-6602

- DJ Pitman International Corporation filed a preliminary permit application in August 1982.
- Stakeholders filed comments on the permit application.
- FERC issued a Draft Environmental Assessment in March 1988.
- FERC notified the Applicant that the project could not be economically and financially feasible in June 1988.
- DJ Pitman International Corporation withdrew their preliminary permit application in July 1988.

Preliminary Permit Docket No. P-11823

- The Town of Newmarket filed a preliminary permit application in September 1999.
- Stakeholders filed comments on the preliminary permit application.
- The Town of Newmarket withdrew their preliminary permit application in March 2000.

Note that FERC maintains a website where more recent communications – like the information for preliminary permit Docket No. P-11823 -- is readily available on-line at the following website: http://elibrary.ferc.gov/idmws/search/fercgensearch.asp. Once on the website, enter the docket number- in this case "P-11823". We suggest the Town review the letters filed with FERC that are on the website to gain a better understanding of the issues and concerns.

Relative to the preliminary permit filed in 1999, the Applicant proposed installing a turbine at the base of the existing gate structure and raising the impoundment elevation by installing 2-foot flashboards[18]. The permit application called for one 600 KW turbine that could operate with flows between 80 and 400 cfs. The reported estimated annual generation was 2,300,000 kilowatt-hours (KWH).

The Applicant estimated the costs for conducting the studies related to engineering, environmental, economic and financing studies as $50,000.

[18] Raising the elevation of the impoundment by 2 feet increases the head available for generation. The greater the head, the higher the generation.

Following the filing of the preliminary permit application with FERC, comments were filed by federal and state agencies, non-government organizations and citizens. Many issues and concerns were noted and presumably the Town came to the conclusion that it was not worth pursuing the project given that they withdrew the preliminary permit in March 2000.

It is not the intent of our study to evaluate the feasibility of hydropower development at Macallen Dam. However, if the Town opts to develop hydropower at Macallen Dam the following should be considered:

- There are upfront costs associated with the FERC licensing process, including studies, as listed above. Based on our experience, the $50,000 estimate in the 1999 preliminary permit application is grossly underestimated.
- There are capital costs associated with developing the site (powerhouse, turbine, substation, transmission, etc).
- There are still costs associated with modifications to the dam necessary to pass the 100-year flood per the NHDES. Developing hydroelectric generation will not ease these requirements.
- The average annual electricity consumption for a US residential customer in 2011 was 11,280 KWh/year (US Energy Information Administration). Assuming that approximately 2,300,000 kWH/year could be produced annually (per the 1999 permit application), it would power approximately 204 homes.
- Assuming the wholesale price of power was $50 to $60/MWH (US Energy Information Administration), a facility producing approximately 2,300,000 kWH/year would yield between $115,000 and $138,000 annually if it was selling to the wholesale power market.
- Other issues could be investigated that could increase the value of the facility's energy. These could include renewable energy credits, certified low-impact hydropower, etc.

Appendix A: Weir Coefficient Memo

Introduction

Gomez and Sullivan is conducting hydraulic modeling (HEC-RAS) of the Lamprey River in the Macallen Dam impoundment as part of a study for the Town of Newmarket (Town) to evaluate the feasibility of potentially removing the dam. As part of our work, we will be calculating the depth of water above the existing Macallen Dam spillway under a variety of flows. This will require quantifying the Macallen Dam spillway's weir coefficient. The weir coefficient is part of the weir equation, which is used to calculate a spillway's flow capacity. The weir equation is described by the equation:

$Q = CLH^{1.5}$, where

Q = is quantity of flow passing over the weir (cfs),
C= is the weir coefficient (feet$^{0.5}$),
L= is the length of the weir (feet), in this case the length of the spillway is 70 feet, and
H= is the depth of water above the weir crest (feet).

The purpose of this memo is to describe our process for quantifying the Macallen Dam's weir coefficient.

As part of our background research, we obtained the Lamprey River HEC-RAS model that Wright-Pierce (W-P) developed as part of their work for the Town. W-P used their model to conduct work associated with their dam break and classification analysis. The objective of their work was to determine the Macallen Dam's 100-yr flood flow (while following NHDES guidelines) and the Macallen Dam's hazard classification. The final report, dated February 6, 2013, describes the work conducted by W-P, including the dam's 100-yr flood flow (10,259 cfs) and the dam's hazard classification (high). The report also includes a cost estimate for several potentially feasible alternatives to bring the dam into compliance with NHDES Dam Bureau dam safety requirements for a high hazard dam[19]. In reviewing the W-P HEC-RAS model and Appendix G of the February W-P report, we noted that a weir coefficient of 2.60 and 2.63 was used in the model and report calculations, respectively.

[19] NHDES Dam Bureau dam safety rules require a dam to pass the design flow with 1-ft of freeboard and no manual operations. The design flow for the Macallen Dam, which is classified as High Hazard, was determined by the W-P study to be the 100-yr flood flow (10,259 cfs).

Methodology

Gomez and Sullivan typically determines weir coefficients by referencing the Handbook of Hydraulics, by Brater and King. The sixth edition is cited in this document for convenience, since the seventh edition has converted all of the equations, tables and coefficients to SI units from English units.

While 2.63 is commonly cited as the weir coefficient for a broad-crested weir, Brater and King notes that the weir coefficient can change with the water height, H:

"*Experiments on broad-crested weirs have been performed by Blackwell, Bazin, Woodburn, the U.S. Deep Waterways Board, and the U.S. Geological Survey. These experiments cover a wide range of conditions as to head, breadth, and height of weir. Considerable discrepancy exists in the results of the different experimenters, especially for heads below 0.5 ft. For heads from 0.5 to about 1.5 ft the coefficient becomes more uniform, and for heads from 1.5 to that at which the nappe becomes detached from the crest, the coefficient as given by the different experiments is nearly constant and equals approximately 2.63. When the head reaches one to two times the breadth, the nappe becomes detached and the weir becomes essentially sharp-crested. The effect on discharge of roughness of the crest can be computed by applying the principals of flow in open channels."*

The dam's geometry is different than a typical broad-crested weir. In particular, the dam features a sloping upstream face (2:1 slope, 3.5' rise, 7' long), with a 1' tall by 2.5' wide "step" on the top of the dam (Figure A-1). There is also a small metal lip in the center of the spillway that is approximately 2" tall. Given the dam's shape, it is possible that the dam spillway could act more like a trapezoidal weir under certain flow conditions. To remain conservative (i.e., not overestimate the spillway flow capacity), however, we suggest modeling the dam as a broad-crested weir rather than as a trapezoidal weir.

Results

Brater and King

Table 5-3 in Brater and King (Figure A-2) tabulates weir coefficients for various weir head and breadth combinations for broad crested weirs. If the flow is high enough to produce 4 feet of head, with a breadth of 2.5 feet, then Table 5-3 would indicate a weir coefficient of 3.32. If we look in Brater and King Table 5-11 (Figure 3), which is for trapezoidal weirs with a sloped upstream face and a downstream vertical face (similar to Macallen Dam), the weir coefficient for a 2:1 (horizontal:vertical) sloped upstream face such as Macallen Dam may be as high as 3.64-3.73, depending on the crest width. Again, while the dam may act more like a trapezoidal weir under some conditions, we believe it is prudent to model the dam spillway as a broad

crested weir. Thus, under conditions where the head is 4.0 feet or higher, we believe it is appropriate to model the Macallen Dam spillway with a weir coefficient of 3.32. For model scenarios that produce less than 4.0 feet of head, or alternatives where the dam breadth is increased, it will be necessary to re-evaluate the spillway's weir coefficient using Brater and King's Table 5-3.

Empirical Data

The New Hampshire Fish and Game Department (NHFG) provided GSE with measured water depths from a consistent location near the Dam's west retaining wall during the eel passage season from 2001 through 2007. The daily average flows at the Packers Falls USGS gage during the measurements ranged from 11 cfs to 1,910 cfs. The measured depths were not measured relative to the spillway crest, so the crest elevation was estimated by extrapolating the measurements at low flows (measurements were taken at flows as low as 11 cfs) to the approximate elevation at 0 cfs. The readings were then normalized to the estimated crest elevation. Water depth measurements indicated the water surface was no more than 3 feet above the spillway crest under all measured conditions, so it was assumed that there was no flow diversion into the Oyster River basin.

The data were plotted versus drainage-area prorated daily average flows from the Packers Falls USGS Gage (Figure A-4). Two elevation versus flow rating curves were developed using the weir equation, with one curve assuming C=2.63 and one curve assuming C=3.32. The flow vs. elevation curve assuming C=3.32 appeared to fit the data better than the curve assuming C=2.63.

Conclusion

This document described our proposed method for calculating the Macallen Dam spillway's weir coefficient. We propose to model the dam as a broad-crested weir and to use the weir coefficients listed in Table 5-3 of Brater and King's sixth edition. For heads greater than 4.0 feet, this translates to a weir coefficient of 3.32. We used historic water level measurements collected by NHFGD to validate this estimation. The validation data showed that a weir coefficient of 3.32 was appropriate for heads between 0.5 feet to 2.0 feet. One can expect the weir coefficient at higher heads to remain at or above those measured at lower heads. Thus, a weir coefficient of 3.32 appears to be appropriate for most situations we will model in this study.

A weir coefficient of 3.32 is approximately 26% higher than the 2.63 weir coefficient used in the W-P report. This translates into the spillway being able to pass 26% more flow than W-P estimated, for a given headwater elevation. Therefore, our hydraulic model and calculations

will show lower water surface elevations than the W-P report indicated, when comparing similar flows. This may also reduce the portion of flow that diverts to the Oyster River at the Route 108 flow split under high flow events.

Figure A-1: Side-view of Macallen Dam.

Table 5-3. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs

Measured head in feet, H_c	Breadth of crest of weir in feet										
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

Figure A-2: Weir-coefficients from Brater and King (sixth edition) for broad crested weirs, as a function of dam breadth and water height above the weir crest.

Table 5-11. Values of C in the Formula $Q = CLH^{3/2}$ for Weirs of Trapezoidal Cross Section with the Upstream Face Inclined and the Downstream Face Vertical

Slope of upstream face	Width of crest in feet	Head in feet, H								
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Hor. Vert.										
2 to 1	0.33	3.85	3.82	3.79	3.77	3.75	3.73	3.70	3.67	3.64
2 to 1	0.66	3.41	3.57	3.65	3.70	3.72	3.72	3.73	3.73	3.73
3 to 1	0.66	....	....	3.57	3.57	3.57	3.57	3.57	3.57	3.57
4 to 1	0.66	....	....	3.48	3.48	3.48	3.48	3.48	3.48	3.48
5 to 1	0.66	....	....	3.39	3.39	3.39	3.39	3.39	3.39	3.39

Figure A-3: Weir coefficients from Brater and King (sixth edition) for trapezoidal weirs with a sloped upstream face and a vertical downstream face.

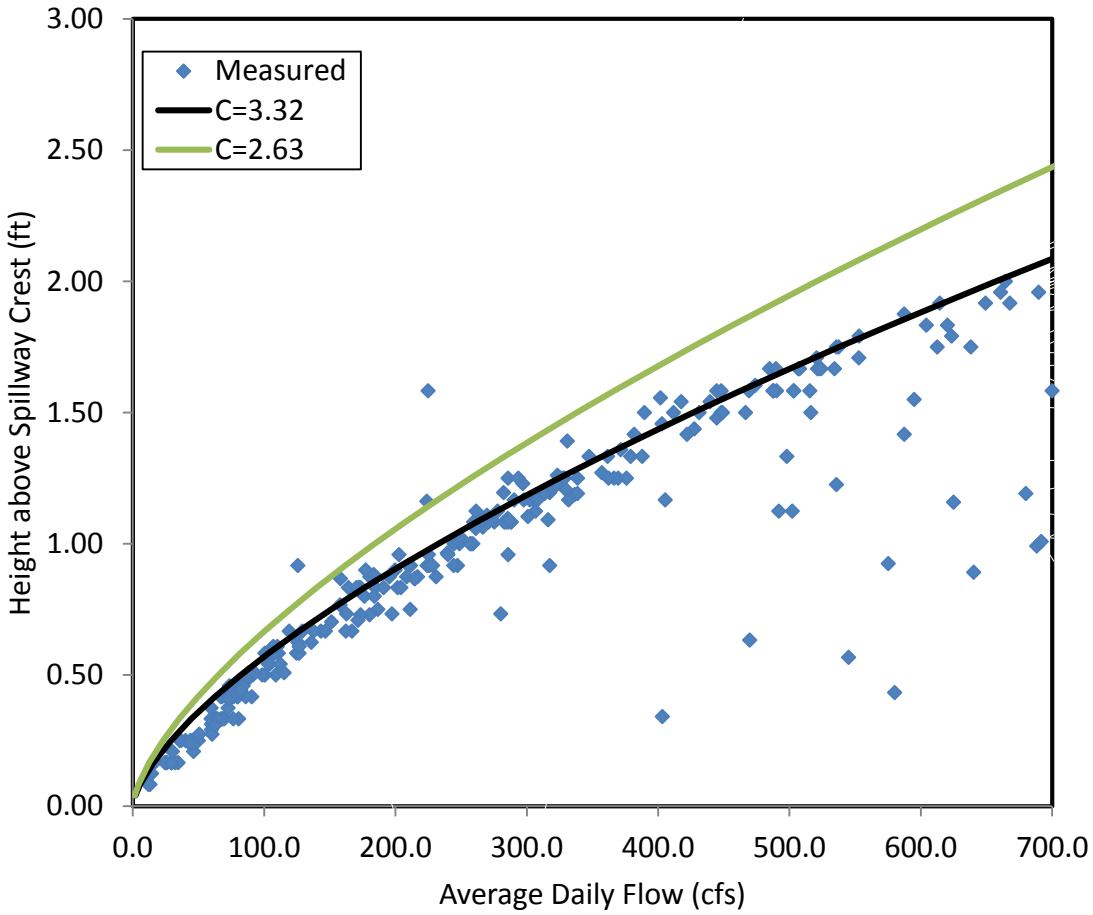

Figure A-4: Flow vs. water depth measurements and calculations for two different weir coefficients (2.63 and 3.32). Additional measurements at daily average flows greater than 700 cfs are not shown. Measurements at higher flows (> 250 cfs) with lower heights above the spillway crest than the curve show may be due to the dam gates being opened during the measurements.

Appendix B: New Hampshire Natural Heritage Bureau Documentation

Town Flag	Species or Community Name	Listed? Federal	Listed? State	# reported last 20 yrs Town	# reported last 20 yrs State
Newmarket					
	Natural Communities - Terrestrial				
**	Rich Appalachian oak rocky woods	--	--	1	16
	Natural Communities - Palustrine				
**	Low-gradient silty-sandy riverbank system	--	--	1	4
**	Red maple - black ash swamp	--	--	2	17
**	Swamp white oak floodplain forest	--	--	1	7
	Natural Communities - Estuarine				
**	High salt marsh	--	--	3	14
	Low brackish riverbank marsh	--	--	Historical	7
**	Low salt marsh	--	--	1	6
**	Salt marsh system	--	--	1	6
**	Sparsely vegetated intertidal system	--	--	1	1
**	Subtidal system	--	--	1	3
	Plants				
*	Atlantic mudwort (*Limosella australis*)	--	E	1	2
	blunt-lobed cliff fern (*Woodsia obtusa*)	--	E	Historical	9
***	climbing hempvine (*Mikania scandens*)	--	E	2	11
	Downy False Foxglove (*Aureolaria virginica*)	--	E	Historical	15
	eastern grasswort (*Lilaeopsis chinensis*)	--	E	Historical	4
**	great bur-reed (*Sparganium eurycarpum*)	--	T	3	20
	green rockcress (*Boechera missouriensis*)	--	T	Historical	14
	hairy wood brome (*Bromus pubescens*)	--	E	Historical	6
**	horned-pondweed (*Zannichellia palustris*)	--	E	1	5
**	little-headed spikesedge (*Eleocharis parvula*)	--	T	2	23
**	Marsh Elder (*Iva frutescens*)	--	T	2	11
	one-glumed spikesedge (*Eleocharis uniglumis*)	--	T	Historical	12
**	perennial saltmarsh American-aster (*Symphyotrichum tenuifolium*)	--	E	1	6
	Philadelphia panicgrass (*Panicum philadelphicum*)	--	E	Historical	8
	prairie wedgescale (*Sphenopholis obtusata*)	--	E	Historical	2
	prolific yellow-flowered knotweed (*Polygonum ramosissimum* ssp. *prolificum*)	--	E	Historical	10
**	red-root umbrella sedge (*Cyperus erythrorhizos*)	--	E	1	3
**	saltmarsh agalinis (*Agalinis maritima*)	--	E	1	10
	seaside brookweed (*Samolus valerandi* ssp. *parviflorus*)	--	E	Historical	5
	slender blue iris (*Iris prismatica*)	--	E	Historical	11
	Trailing Bush-clover (*Lespedeza procumbens*)	--	E	Historical	3
**	tufted yellow-loosestrife (*Lysimachia thyrsiflora*)	--	T	1	10
	Tundra Alkali Grass (*Puccinellia pumila*)	--	E	Historical	7
	Vertebrates - Mammals				
***	Northern Long-eared Bat (*Myotis septentrionalis*)	--	SC	1	9
	Vertebrates - Birds				
**	Bald Eagle (*Haliaeetus leucocephalus*)	--	T	1	88
**	Osprey (*Pandion haliaetus*)	--	SC	2	103

Listed? E = Endangered T = Threatened SC = Special concern

Flags
**** = Highest importance
*** = Extremely high importance
** = Very high importance
* = High importance

These flags are based on a combination of (1) how rare the species or community is and (2) how large or healthy its examples are in that town. Please contact the Natural Heritage Bureau at (603) 271-2214 to learn more about approaches to setting priorities.

Town Flag	Species or Community Name	Listed? Federal	Listed? State	# reported last 20 yrs Town	# reported last 20 yrs State
**	Saltmarsh Sparrow (*Ammodramus caudacutus*)	--	SC	1	8
	Sedge Wren (*Cistothorus platensis*)	--	E	Historical	4
	Sora (*Porzana carolina*)	--	SC	Historical	2
	Vertebrates - Reptiles				
***	Blanding's Turtle (*Emydoidea blandingii*)	--	E	34	709
***	Spotted Turtle (*Clemmys guttata*)	--	T	2	119
**	Wood Turtle (*Glyptemys insculpta*)	--	SC	3	193
	Vertebrates - Amphibians				
**	Jefferson/Blue-spotted Salamander Complex (*Ambystoma hybrid pop. 3*)	--	--	1	8
	Vertebrates - Fish				
**	American Eel (*Anguilla rostrata*)	--	SC	2	177
	Invertebrates - Ants & Wasps				
**	Fen Ant (*Lasius minutus*)	--	--	1	2
**	Seaside Dragonlet (*Erythrodiplax berenice*)	--	--	1	12
Newport					
	Plants				
	hollow Joe-Pye weed (*Eutrochium fistulosum*)	--	E	Historical	10
	Vertebrates - Birds				
	Common Nighthawk (*Chordeiles minor*)	--	E	Historical	9
	Vertebrates - Reptiles				
**	Wood Turtle (*Glyptemys insculpta*)	--	SC	2	193
	Invertebrates - Mollusks				
****	Brook Floater (*Alasmidonta varicosa*)	--	E	1	32
Newton					
	Natural Communities - Palustrine				
***	Atlantic white cedar - yellow birch - pepperbush swamp	--	--	2	20
**	Seasonally flooded Atlantic white cedar swamp	--	--	1	3
***	Swamp white oak floodplain forest	--	--	1	7
	Temperate minor river floodplain system	--	--	Historical	7
	Plants				
**	weak stellate sedge (*Carex seorsa*)	--	E	1	3
	Vertebrates - Reptiles				
*	Blanding's Turtle (*Emydoidea blandingii*)	--	E	1	709
**	Spotted Turtle (*Clemmys guttata*)	--	T	3	119
	Invertebrates - Dragonflies & Damselflies				
**	Mocha Emerald (*Somatochlora linearis*)	--	--	1	4
	Invertebrates - Mollusks				
**	Eastern Pond Mussel (*Ligumia nasuta*)	--	SC	1	8

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Town Flag	Species or Community Name	Listed? Federal	State	# reported last 20 yrs Town	State
Durham					
	Natural Communities - Terrestrial				
**	Hemlock - beech - oak - pine forest	--	--	1	11
**	Rich Appalachian oak rocky woods	--	--	1	16
	Natural Communities - Palustrine				
**	Herbaceous seepage marsh	--	--	1	5
**	Kettle hole bog system	--	--	1	24
**	Red maple - lake sedge swamp	--	--	1	1
**	Red maple - red oak - cinnamon fern forest	--	--	1	2
**	Red maple - Sphagnum basin swamp	--	--	1	8
*	Red maple floodplain forest	--	--	1	15
	Natural Communities - Estuarine				
**	Brackish marsh	--	--	2	12
**	High salt marsh	--	--	3	14
**	Salt marsh system	--	--	1	6
**	Sparsely vegetated intertidal system	--	--	1	1
**	Subtidal system	--	--	1	3
	Plants				
	American Waterwort (*Elatine americana*)	--	E	Historical	2
**	Beck's water-marigold (*Bidens beckii*)	--	T	2	12
**	Black Maple (*Acer nigrum*)	--	T	2	10
**	blunt-lobed cliff fern (*Woodsia obtusa*)	--	E	1	9
**	crested sedge (*Carex cristatella*)	--	E	3	12
	Downy False Foxglove (*Aureolaria virginica*)	--	E	Historical	15
	Dwarf Glasswort (*Salicornia bigelovii*)	--	E	Historical	7
	Engelmann's Quillwort (*Isoetes engelmannii*)	--	E	Historical	15
	forked rush (*Juncus dichotomus*)	--	E	Historical	1
	Giant Rhododendron (*Rhododendron maximum*)	--	T	Historical	13
**	great bur-reed (*Sparganium eurycarpum*)	--	T	6	20
	greater fringed-gentian (*Gentianopsis crinita*)	--	T	Historical	28
**	green rockcress (*Boechera missouriensis*)	--	T	1	14
	hairy wood brome (*Bromus pubescens*)	--	E	Historical	6
	horned-pondweed (*Zannichellia palustris*)	--	E	Historical	5
**	ivy-leaved duckweed (*Lemna trisulca*)	--	E	1	5
	lake quillwort (*Isoetes lacustris*)	--	E	Historical	5
	Leafy Bulrush (*Scirpus polyphyllus*)	--	E	Historical	3
	little-headed spikesedge (*Eleocharis parvula*)	--	T	Historical	23
**	Loesel's wide-lipped orchid (*Liparis loeselii*)	--	T	1	25
**	long-leaved pondweed (*Potamogeton nodosus*)	--	T	1	24
*	Marsh Elder (*Iva frutescens*)	--	T	2	11
	Marsh Horsetail (*Equisetum palustre*)	--	E	Historical	12
	Netted Chain Fern (*Woodwardia areolata*)	--	E	Historical	4
	Northern Blazing Star (*Liatris novae-angliae*)	--	E	Historical	16
**	northern tubercled bog-orchid (*Platanthera flava* var. *herbiola*)	--	E	1	11
	Pale Duckweed (*Lemna valdiviana*)	--	E	Historical	4

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Town Flag	Species or Community Name	Listed? Federal	State	# reported last 20 yrs Town	State
	Philadelphia panicgrass (*Panicum philadelphicum*)	--	E	Historical	8
	prairie wedgescale (*Sphenopholis obtusata*)	--	E	Historical	2
**	prolific yellow-flowered knotweed (*Polygonum ramosissimum* ssp. *prolificum*)	--	E	1	10
	Purple Milkweed (*Asclepias purpurascens*)	--	E	Historical	4
	purple virgin's-bower (*Clematis occidentalis*)	--	E	Historical	25
	Rigid Sedge (*Carex tetanica*)	--	--	Historical	1
	rufous bulrush (*Scirpus pendulus*)	--	E	Historical	5
**	saltmarsh agalinis (*Agalinis maritima*)	--	E	1	10
	sharp-flowered manna grass (*Glyceria acutiflora*)	--	E	Historical	9
	smooth black sedge (*Carex nigra*)	--	E	Historical	11
	smooth rockcress (*Boechera laevigata*)	--	E	Historical	6
*	stout dotted smartweed (*Persicaria robustior*)	--	E	1	6
**	tufted yellow-loosestrife (*Lysimachia thyrsiflora*)	--	T	1	10
	Tundra Alkali Grass (*Puccinellia pumila*)	--	E	Historical	7
*	Turk's-cap lily (*Lilium superbum*)	--	E	1	1
	Virginia three-seeded-Mercury (*Acalypha virginica*)	--	E	Historical	5
**	water-plantain crowfoot (*Ranunculus ambigens*)	--	E	1	3
	Vertebrates - Mammals				
**	New England Cottontail (*Sylvilagus transitionalis*)	--	E	1	21
	Vertebrates - Birds				
**	Bald Eagle (*Haliaeetus leucocephalus*)	--	T	1	88
**	Common Tern (*Sterna hirundo*)	--	T	1	9
	Golden-winged Warbler (*Vermivora chrysoptera*)	--	SC	Historical	4
**	Least Bittern (*Ixobrychus exilis*)	--	SC	1	4
**	Osprey (*Pandion haliaetus*)	--	SC	5	103
**	Sedge Wren (*Cistothorus platensis*)	--	E	1	4
**	Upland Sandpiper (*Bartramia longicauda*)	--	E	1	6
	Vesper Sparrow (*Pooecetes gramineus*)	--	SC	Historical	12
	Vertebrates - Reptiles				
***	Blanding's Turtle (*Emydoidea blandingii*)	--	E	17	709
	Eastern Hognose Snake (*Heterodon platirhinos*)	--	E	Historical	41
**	Northern Black Racer (*Coluber constrictor constrictor*)	--	T	1	54
***	Spotted Turtle (*Clemmys guttata*)	--	T	4	119
**	Wood Turtle (*Glyptemys insculpta*)	--	SC	2	193
	Vertebrates - Fish				
	American Brook Lamprey (*Lampetra appendix*)	--	E	Historical	2
**	American Eel (*Anguilla rostrata*)	--	SC	7	177
	Atlantic Sturgeon (*Acipenser oxyrinchus*)	--	--	Historical	1
**	Banded Sunfish (*Enneacanthus obesus*)	--	SC	1	30
**	Redfin Pickerel (*Esox americanus americanus*)	--	SC	1	32
**	Sea Lamprey (*Petromyzon marinus*)	--	SC	1	5
**	Swamp Darter (*Etheostoma fusiforme*)	--	SC	1	13
	Invertebrates - Butterflies & Moths				
	A Noctuid Moth (*Chaetaglaea cerata*)	--	--	Historical	5

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Town Flag	Species or Community Name	Listed? Federal	State	# reported last 20 yrs Town	State
	A Noctuid Moth (*Chytonix sensilis*)	--	--	Historical	3
	A Noctuid Moth (*Feltia manifesta*)	--	--	Historical	2
	Bog Elfin (*Callophrys lanoraieensis*)	--	--	Historical	1
	Columbine Duskywing (*Erynnis lucilius*)	--	--	Historical	4
	Frosted Elfin (*Callophrys irus*)	--	E	Historical	7
	Lyre-tipped Spreadwing (*Lestes unguiculatus*)	--	--	Historical	5
***	Ringed Boghaunter (*Williamsonia lintneri*)	--	E	2	13
**	Seaside Dragonlet (*Erythrodiplax berenice*)	--	--	2	12
	Taiga Bluet (*Coenagrion resolutum*)	--	--	Historical	17
East Kingston					
	Natural Communities - Palustrine				
**	Atlantic white cedar - yellow birch - pepperbush swamp	--	--	1	20
	Red maple - sensitive fern swamp	--	--	Historical	10
**	Swamp white oak basin swamp	--	--	1	5
***	Swamp white oak floodplain forest	--	--	1	7
	Temperate minor river floodplain system	--	--	Historical	7
	Plants				
	Acadian Quillwort (*Isoetes acadiensis*)	--	E	Historical	3
**	American featherfoil (*Hottonia inflata*)	--	E	1	7
	Engelmann's Quillwort (*Isoetes engelmannii*)	--	E	Historical	15
	Vertebrates - Amphibians				
**	Jefferson/Blue-spotted Salamander Complex (*Ambystoma hybrid pop. 3*)	--	--	1	8
	Vertebrates - Fish				
	American Eel (*Anguilla rostrata*)	--	SC	Historical	177
	Invertebrates - Mollusks				
**	Eastern Pond Mussel (*Ligumia nasuta*)	--	SC	1	8
Easton					
	Natural Communities - Terrestrial				
***	High-elevation spruce - fir forest system	--	--	1	10
**	Semi-rich mesic sugar maple forest	--	--	1	20
	Natural Communities - Palustrine				
**	High-gradient rocky riverbank system	--	--	1	9
*	Medium level fen system	--	--	1	62
	Plants				
*	Lindley's American-aster (*Symphyotrichum ciliolatum*)	--	T	1	12
	Mountain Firmoss (*Huperzia appressa*)	--	E	Historical	14

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Appendix C: FERC Correspondence Relative to Town of Newmarket's Preliminary Permit Application to Develop Hydropower at Macallen Dam

Date of Correspondence	Correspondence Filed with Federal Energy Regulatory Commission
9/14/1999	Town of Newmarket files for a Preliminary Permit Application to develop hydropower at Macallen Dam
1/11/2000	FERC issues Notice of Application Accepted for Filing and Soliciting Motions to Intervene and Protests
2/17/2000	New Hampshire Fish and Game Department files Protest regarding Application for a Preliminary Permit for the Macallen Dam
2/28/2000	Coastal Conservation Association of New Hampshire files Protest regarding Application for a Preliminary permit for the Macallen Dam
3/03/2000	National Marine Fisheries Service files comments regarding Application for a Preliminary Permit for the Macallen Dam
3/03/2000	Kirsten and Hunter Brownlie files Protest regarding Application for a Preliminary Permit for the Macallen Dam
3/06/2000	Town of Newmarket withdraws Preliminary Permit Application for the Macallen Dam
3/07/2000	United States Fish and Wildlife Service files comments regarding Application for a Preliminary Permit for the Macallen Dam
3/08/2000	Samuel Preston files comments regarding Application for a Preliminary Permit for the Macallen Dam

ORIGINAL

P-11823-000

FEDERAL ENERGY REGULATORY COMMISSION
PRELIMINARY PERMIT APLLICATION

MACALLEN DAM PROJECT

BY:

Town of Newmarket
Newmarket, New Hampshire
Town Hall
186 Main Street
Newmarket, New Hampshire 03857

September 14, 1999

9909290103-3

SFC ENGINEERING PARTNERSHIP INC.

ORIGINAL

SFC ENGINEERING PARTNERSHIP INC.

September 14, 1999

FILED
OFFICE OF THE SECRETARY
99 SEP 27 PM 3:42
FEDERAL ENERGY
REGULATORY
COMMISSION

Mr. David Boerger, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Room 1A
Washington, DC 20426

P-11823-000

RE: **Macallen Dam Project**
Newmarket, NH

Dear Mr. Boerger:

On behalf of the municipality, the Town of Newmarket, New Hampshire, SFC Engineering Partnership, Inc is submitting one (1) complete original and eight (8) copies of the preliminary permit application for the Macallen Dam Project in Newmarket, New Hampshire.

Additionally, We also have included three (3) additional copies of the application which we request "time stamped" and returned in the self-addressed, postage paid envelope.

If there is the need to answer any questions, or provide further information, please contact Mr. Alphonsen R. Dixon, Town Administrator, at (603) 659-3617, or the undersigned at (603) 647-8700.

Sincerely,

SFC ENGINEERING PARTNERSHIP, INC.

John R Lavigne Jr

John R. Lavigne Jr., P.E.
Vice President
/nsc

CC: A. Dixon, Newmarket

Attachments

Firehydro/24380 1/doc/letter

FERC DOCKETED
SEP 27 1999.

25 SUNDIAL AVE., SUITE 205W • MANCHESTER, NH 03103-7230 • (603) 647-8700 • FAX 647-8711

MACALLEN DAM PROJECT
Application for Preliminary Permit

ATTACHMENT A
(Communities within 15-mile Radius with +5,000 Population)

NEW HAMPSHIRE

BARRINGTON – Strafford County
Town Office
41 Province Lane
Barrington, NH 03825

DOVER – Strafford County
Municipal Building
288 Central Avenue
Dover, NH 03820

DURHAM – Strafford County
Town Office
15 Newmarket Road
Durham, NH 03824

EPPING – Rockingham County
Town Office
157 Main Street
Epping, NH 03042

EXETER – Rockingham County
Town Office
10 Front Street
Exeter, NH 03833

HAMPTON – Rockingham County
Town Office
136 Winnacunnet Road
Hampton, NH 03842

KINGSTON – Rockingham County
Town Office
163 Main Street
PO Box 716
Kingston, NH 03848

NEWMARKET – Rockingham County
Town Office
186 Main Street
Newmarket, NH 03857

PORTSMOUTH – Rockingham County
City Office
One Junkins Avenue
Portsmouth, NH 03801

RAYMOND – Rockingham County
Town Office
4 Epping Street
Raymond, NH 03077

ROCHESTER – Strafford County
City Office
31 Wakefield Street
Rochester, NH 03867

SOMERSWORTH – Strafford County
City Office
157 Main Street
Somersworth, NH 03878

STRATHAM – Rockingham County
Town Office
10 Bunker Hill Avenue
Stratham, NH 0385

MAINE

BERWICK – York County
NORTH BERWICK
SOUTH BERWICK
Town Office
21 Main Street,
North Berwick, ME 03906

ELLIOT – York County
Town Office
141 State Road
Eliot, ME 03903

KITTERY – York County
Town Office
200 Rogers Road
Kittery, ME 03904

YORK – York County
Town Office
186 York Street
York, ME 03909

MASSACHUSETTS

AMESBURY – Essex County
Town Office
62 Friend Street
Amesbury, MA 01913

SALISBURY – Essex County
Town Office
5 Beach Road
Salisbury, MA 01952

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VERIFICATION OF STATEMENT

This application is executed in the state of New Hampshire County of Hillsborough, ss by:

John R. Lavigne, Jr., PE
SFC Engineering Partnership, Inc. (Name)

25 Sundial Avenue, Suite 205W (Address)

Manchester, NH 03103 - 7230,

states that he is authorized to act in behalf of the corporation, being duly sworn, depose and say that the contents of this application are true to the best of his knowledge or belief. The undersigned applicant has signed this 21 day of September, 1999.

Town of Newmarket
(Applicant)

By: John R Lavigne Jr

John R. Lavigne Jr., P.E.
Vice President
SFC Engineering Partnership, Inc.
Agent for the Town of Newmarket, NH

Subscribed and sworn to before me, a (Notary Public, or title of other official authorized by the state of notarize documents, as appropriate) of the State of New Hampshire this 21 day of September, 1999.

(Seal)

Notary, or other authorized official)

...ERNANDEZ, Notary Public
My Commission Expires March 4, 2003

INITIAL STATEMENT

P-11823-000

ORIGINAL

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION
APPLICATION FOR PRELIMINARY PERMIT

MACALLEN DAM PROJECT
NEWMARKET, NH

INITIAL STATEMENT

The Town of Newmarket, New Hampshire (TOWN) applies to the Federal Energy Regulatory Commission (FERC) for a Preliminary Permit for the Macallen Dam Project (PROJECT), as described in the attached exhibits. This application is made in order that the applicant may secure and maintain priority of application for a license for the PROJECT under Part I of the Federal Power Act while obtaining the data and performing the acts required to determine the feasibility of the PROJECT and to support an application for a license. At this time, The Town of Newmarket intends to obtain and maintain any proprietary rights necessary to construct, operate, and maintain the Macallen Dam Project. The proposed term of the requested permit is twenty-four (24) months.

(1) The location of the PROJECT is:

State of New Hampshire
Rockingham County
Town of Newmarket
Lamprey River

(2) A. The exact name and address of the applicant is:

Alphonsen R. Dixon, Town Administrator
Town of Newmarket, NH
Town Hall
186 Main Street
Newmarket, NH 03857
(603) 659-3617

The Town of Newmarket, NH (TOWN) is a municipality incorporated under the laws of the State of New Hampshire.

B. The exact name and business address of the agent authorized by the Town of Newmarket, NH to act as an agent in this application is:

John R. Lavigne, Jr., P.E.
SFC Engineering Partnership, Inc.
25 Sundial Avenue, Suite 205W
Manchester, NH 03103
(603) 647-8700

(3) The existing dam and appurtenant works are owned by:

The Town of Newmarket, NH
Town Hall
186 Main Street
Newmarket, NH 03857

EXHIBIT 1

DESCRIPTION OF THE PROPOSED PROJECT

EXHIBIT 1
Project Description

(1) A. Dam

The Macallen Dam is an existing structure which spans the Lamprey River in downtown Newmarket, New Hampshire, approximately 200-feet downstream from the Route 108 Bridge. A gravity structure, constructed of stone and concrete masonry with earth-filled abutments, the dam is approximately 100-feet long with a 27-foot structural height. The spillway is a stone masonry broad-crested weir. It is approximately 68-feet in length with a crest elevation of 21.23-feet (NGVD). A concrete fish ladder operated by the New Hampshire Fish and Game Department is located on the right side (looking downstream) of the spillway. The outlet works are located at the left abutment of the dam and consist of three motor-operated waste gates. Each gate is approximately 7-feet square, and their invert elevation is approximately 7-feet below the crest of the spillway. The control panel for each gate motor operator is located at the top of the outlet works platform.

B. Other Structures

Remnants of intake structures and a canal from the historic hydropower development at Macallen Dam still exist. One intake, which was located on the right side of the dam, was filled with earth when the project was decommissioned in the early 1950's. The connecting 220-foot long canal was also filled in at that time. Remnants of the abandoned draft tube and penstock leading from the canal are found in the basements of the adjacent mill buildings. Additional remnants remain from the water conveyance system located on the left side of the dam.

C. General Description of Proposed Redevelopment

The proposed hydropower redevelopment at Macallen Dam would utilize the existing dam and gate structure. The dam historically supported 46-1/2" flashboards but now operates unregulated with no flashboards. No major alterations are planned for the dam, however, to maximize redevelopment potential, the Applicant plans to investigate the feasibility of re-installing some height of flashboards on the spillway crest.

The redevelopment plans will also consider the site limitations imposed with regard to the fishway. The major objective of the design studies will be to achieve maximum possible power production while maintaining existing and future fishway operations.

(2) Reservoir

The impoundment length behind the dam at elevation 21.23-feet (NGVD) is approximately 2.6 miles, with a surface area of 120 acres. The approximate storage capacity of the reservoir at elevation 21.23-feet is 480 acre-feet. From

past studies, with the addition of 24" flashboards which will be investigated under the preliminary permit, the length of the impoundment would still be approximately 2.6 miles long and the surface area and capacity would increase to approximately 140 acres, and 740 acre-feet, respectively. Proposed reservoir conditions will be studied as part of the proposed study plan as defined in *Exhibit 2*.

(3) Transmission Lines

Public Service Company of New Hampshire has a 19.9 KV utility line that runs along North Main Street in Newmarket, NH. A pad mount transformer will step the generator voltage (480V) up the line voltage at an appropriate interconnection point. Proposed power transmission line connections will be analyzed as part of the proposed study plan as defined in *Exhibit 2*.

(4) Generating Equipment

No existing units are currently operating at this site. Based on previous studies and redevelopment plans with 2-foot high flashboards (El.23.23'), the PROJECT can support an installed generating capacity of approximately 600 KW. Generating units are expected to consist of one 600 KW induction or synchronous type generator with an adjustable blade 1500-MM, 750 HP propeller turbine. The generator is designed to produce electricity efficiently from 600 KW down to approximately 240 KW, and the turbine unit can operate efficiently from 400 cfs to 80 cfs. The estimated annual generation for this station should be approximately 2,300,000 KWH.

Normal tailwater elevation and consequently net head is tidally dependent. Average gross head at this site is between 22.8-feet at high tide to 23.8-feet at low tide. Previous calculations indicate that the system will produce minimal head losses (approximately 4-inches) with the turbine/generator unit operating at maximum capacity if the plant were designed to operate under a net head of approximately 23-feet.

The PROJECT is expected to be a totally automated run-of-river station. It will have all necessary safeguards to assure proper operation. This station will not be used for peaking purposes. Redevelopment plans will include no water-cooled bearings, or any process water discharge. This project will not create any solid waste discharge material.

Generating equipment proposed based on previous redevelopment plans and studies will be reviewed and evaluated with the most current regulations as part of the proposed study plan as defined in *Exhibit 2* to confirm viability with present needs and guidelines.

(5) No Federal Lands are known to exist within the project boundaries.

(6) Project Justification

The purpose of this project is to re-establish hydroelectric power at this site. This application is being made to provide the TOWN with the necessary means to investigate the feasibility of redevelopment. The TOWN proposes to develop this site for the purpose of providing reasonably priced power to the area mills through the creation of an "enterprise zone" or for the sale of the power to an outside distributor.

The intent of the proposed project is to develop the existing site to provide clean, efficient energy to the public and/or private sector while conserving, and preserving, the surrounding environment. The project will utilize an existing dam where the potential waterpower is currently not being actualized. The redevelopment of an abandoned site in connection with an established historic district increases both the value and safety of the area. Operation of the existing fish ladder will be optimized with active site maintenance and will enhance continued recreation fishing along the reach. Further, the TOWN may realize additional income through the sale of the power, if determined cost-effective, and thus may provide relief for taxpayers.

The PROJECT is expected to have minimal negative effects on land and water resources within the project area. In previous reports, the State Historic Preservation Office determined that the project as proposed would have no adverse effect on known architectural, historical, archeological and cultural resources. Environmental impacts, if any, will be identified during the studies, and the plans will be developed to minimize and/or mitigate the impacts.

The PROJECT will be developed in coordination with all local, state, and federal agencies and guidelines and the Applicant will make every effort to address the concerns and requests of such agencies.

EXHIBIT 2

STUDY PLAN

EXHIBIT 2
Study Plan

(1) A. Study Plan

1. Engineering Study

   a. Complete deed research for project site and identify abutters.

   b. Prepare a topographic survey of the PROJECT accurately delineating the horizontal and vertical relationships of all existing project features.

   c. Develop site specific flow-duration data for the PROJECT based on established USGS gagings.

   d. Perform exploratory soil/rock borings as required for design and reconstruction of the dam and powerhouse.

   e. Analyze possible development schemes to determine a plan which best optimizes project features and maximizes power generation while minimizing environmental impacts.

   f. Prepare plans depicting the optimal development scheme.

   g. Prepare estimates of construction costs of the selected development scheme.

2. Environmental Study

   a. Conduct a visual inspection to determine the environmental characteristics of the project site.

   b. Determine and/or conduct any in-stream studies to assess the existing aquatic habitat affected by the PROJECT.

   c. Meet with personnel from the US Fish & Wildlife Services to discuss the potential environmental impacts of the PROJECT.

   d. Determine the need for any minimum flow release.

   e. Prepare all documentation and studies required as part of *Exhibit E*, FERC license application.

   f. Consult with all agencies having review responsibilities under local, state, and federal regulations.

3. Socioeconomic Studies

   a. Consult with State Historic/Archeological agency to determine locally sensitive areas, if any.

   b. Develop an inventory of local recreational areas and activities to determine and mitigate negative impacts, if any.

c. Hold public hearing(s) to present and discuss the project with the local community.

4. Economic Studies

   a. Determine internal (within Newmarket) and external (adjacent mill complex) electric load needs with future requirements.

   b. Establish an economic model for the use and sale of the power produced from the PROJECT.

5. Financial Studies

   a. Investigate financing methods and estimate the cost of money at the time of construction.

   b. Based on project costs, financing costs, and the value of the energy, determine the cost benefit and risks of undertaking the redevelopment of the site.

   c. File a license (or exemption) application with the Federal Energy regulatory Commission.

B. New Roads

There will be no new roads built for the purpose of conducting studies. Existing roads will be utilized for access to the site. The vehicle(s) used for taking samples and borings will be all-terrain.

(2) New Dam Construction

No new dam construction is anticipated for the redevelopment of this site.

(3) Waiver

Any field studies, tests or other activities to be conducted under the preliminary permit will not adversely affect cultural resources, or endangered species; nor will adjacent land or waters be disturbed or affected. As such a waiver from the commission's requirements of paragraph (c) (2) pursuant to § 385.207 of chapter I is being requested as part of this preliminary permit application.

EXHIBIT 3

STATEMENT OF COSTS AND FINANCING

EXHIBIT 3
Statement of Costs and Financing

(1) Estimated Cost of Studies

The estimated costs for undertaking the studies outlined in *Exhibit 2* are as follows:

(1) Engineering Study	$ 15,000
(2) Environmental Study	$ 15,000
(3) Economic Study	$ 10,000
(4) Financial Study	$ 10,000
Total Estimated Cost of Studies and Preparatory Work	**$ 50,000**

(2) Source(s) of Financing

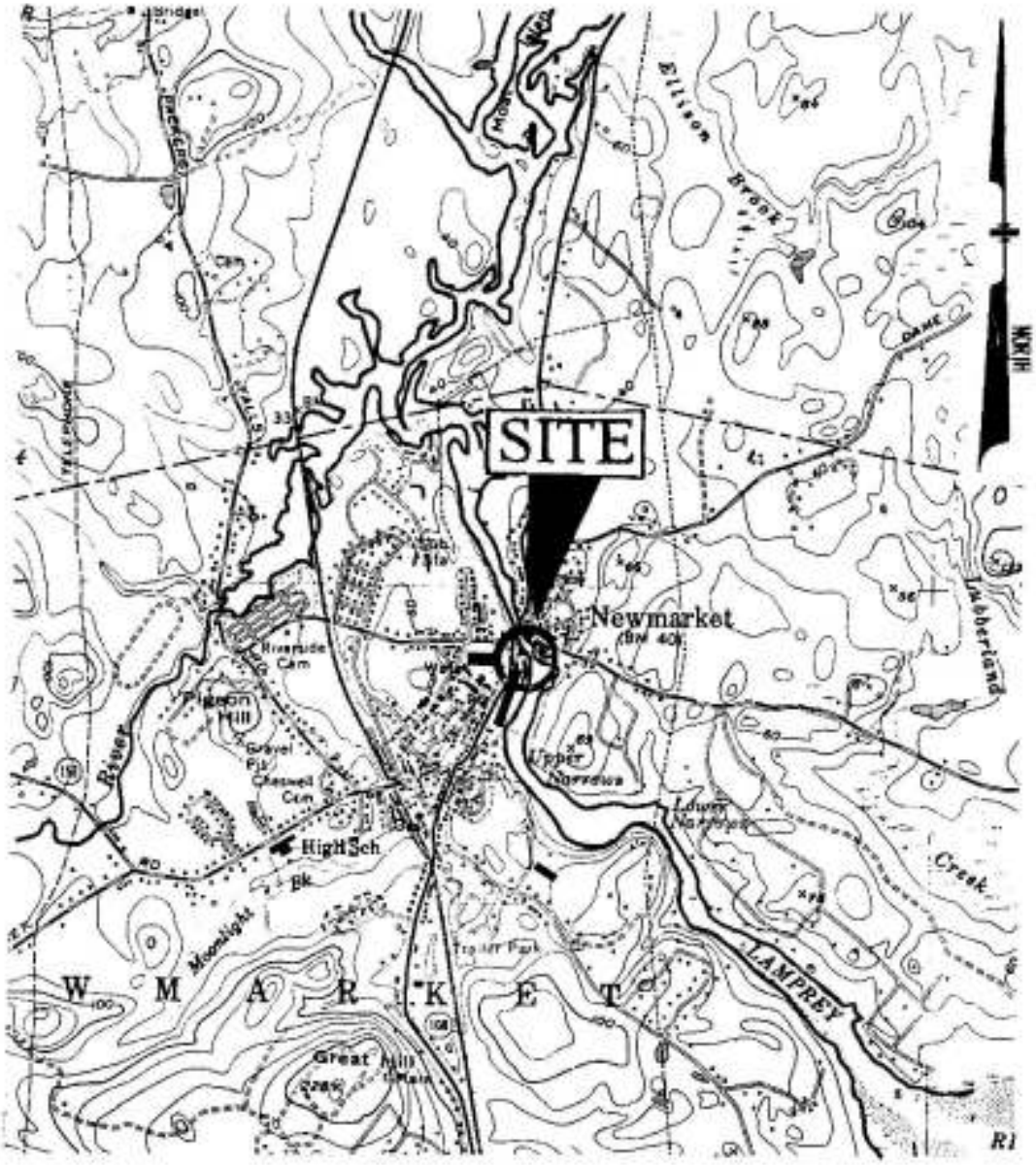
All studies and preparatory work will be financed internally by the TOWN.

(3) Proposed Market for Power

The proposed market for the power generated by this project is the municipality and adjacent mill complex. The arrangement and contract for the purchase and internal use of the generated power will be determined and established as part of the economic studies as defined in *Exhibit 2*.

EXHIBIT 4

PROJECT MAPS



SCALE: 1:24,000
CONTOUR INTERVAL 20 FEET

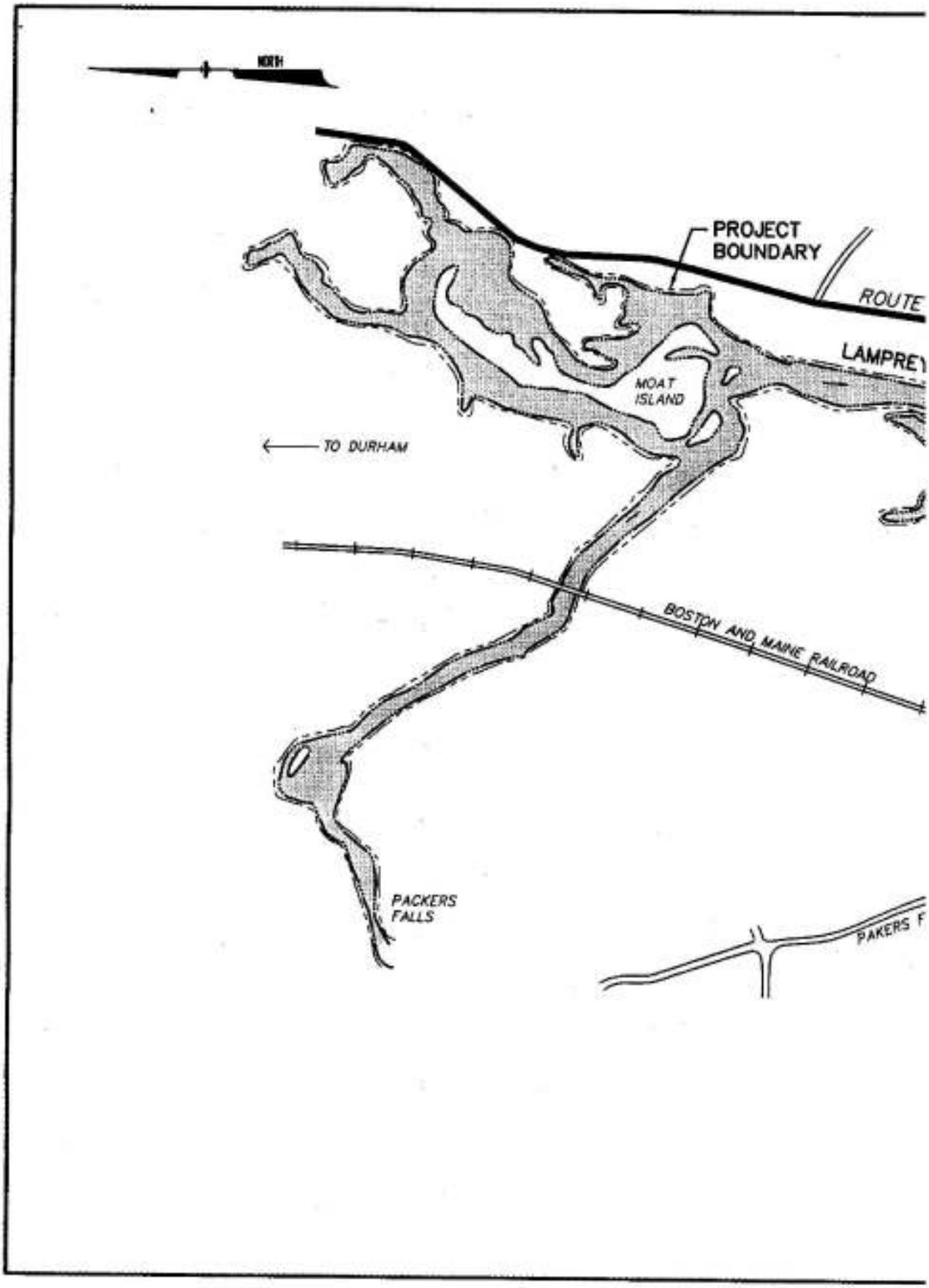
DAM NAME: **MACALLEN DAM**
CITY/TOWN: **NEWMARKET, NH**
USGS SOURCE: NEWMARKET, NH
SOURCE DATE: 1988

DAM NUMBER:

TAX MAP/LOT:

FIGURE 1
SITE LOCATION MAP

SFC ENGINEERING PARTNERSHIP, INC.
25 SUNDIAL AVENUE, SUITE 205N
MANCHESTER, NH 03103-7232
TEL. 603-647-8700
FAX. 603-647-8711


NORTH
PROJECT BOUNDARY
ROUTE
LAMPREY
MOAT ISLAND
TO DURHAM
BOSTON AND MAINE RAILROAD
PACKERS FALLS
PAKERS F

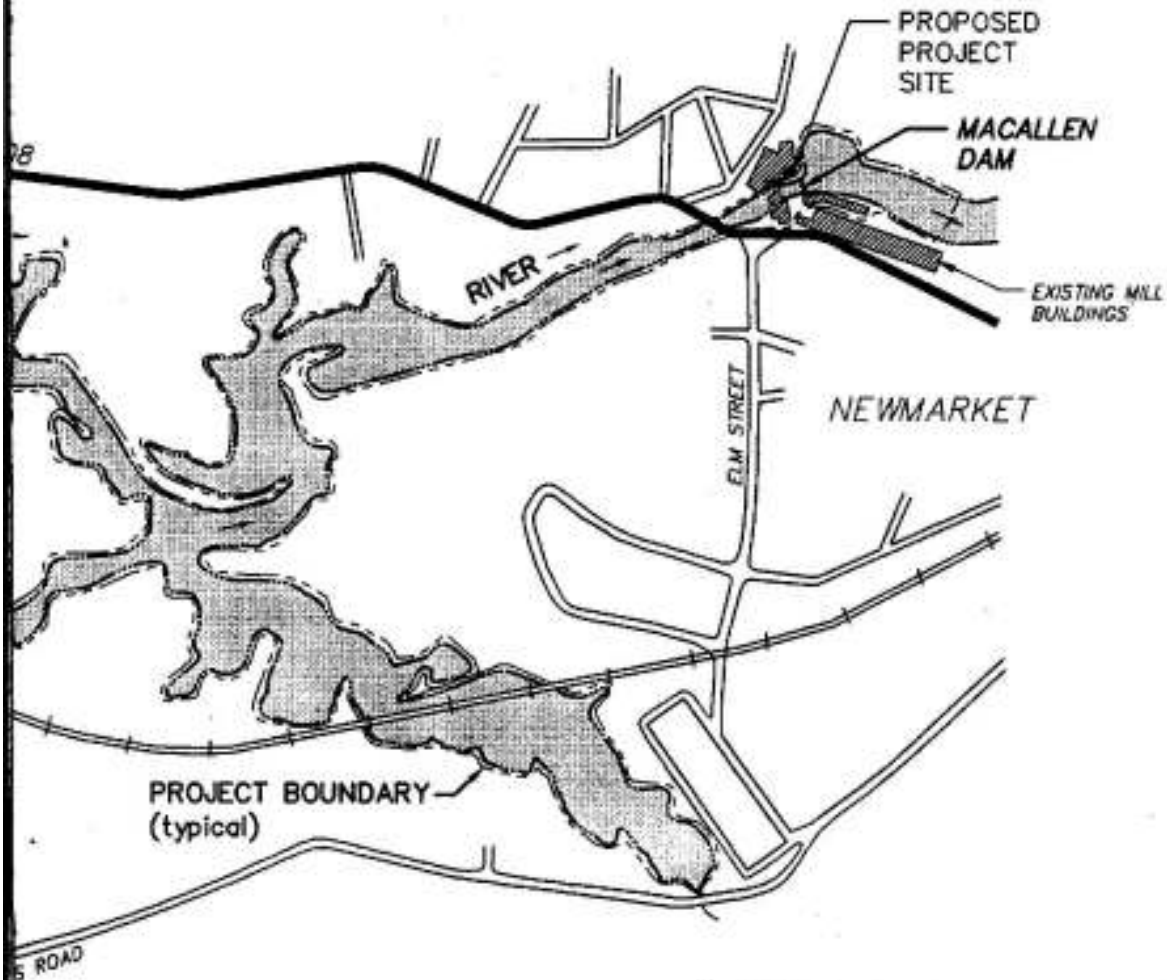


EXHIBIT 4 SHEET: 1 OF 4

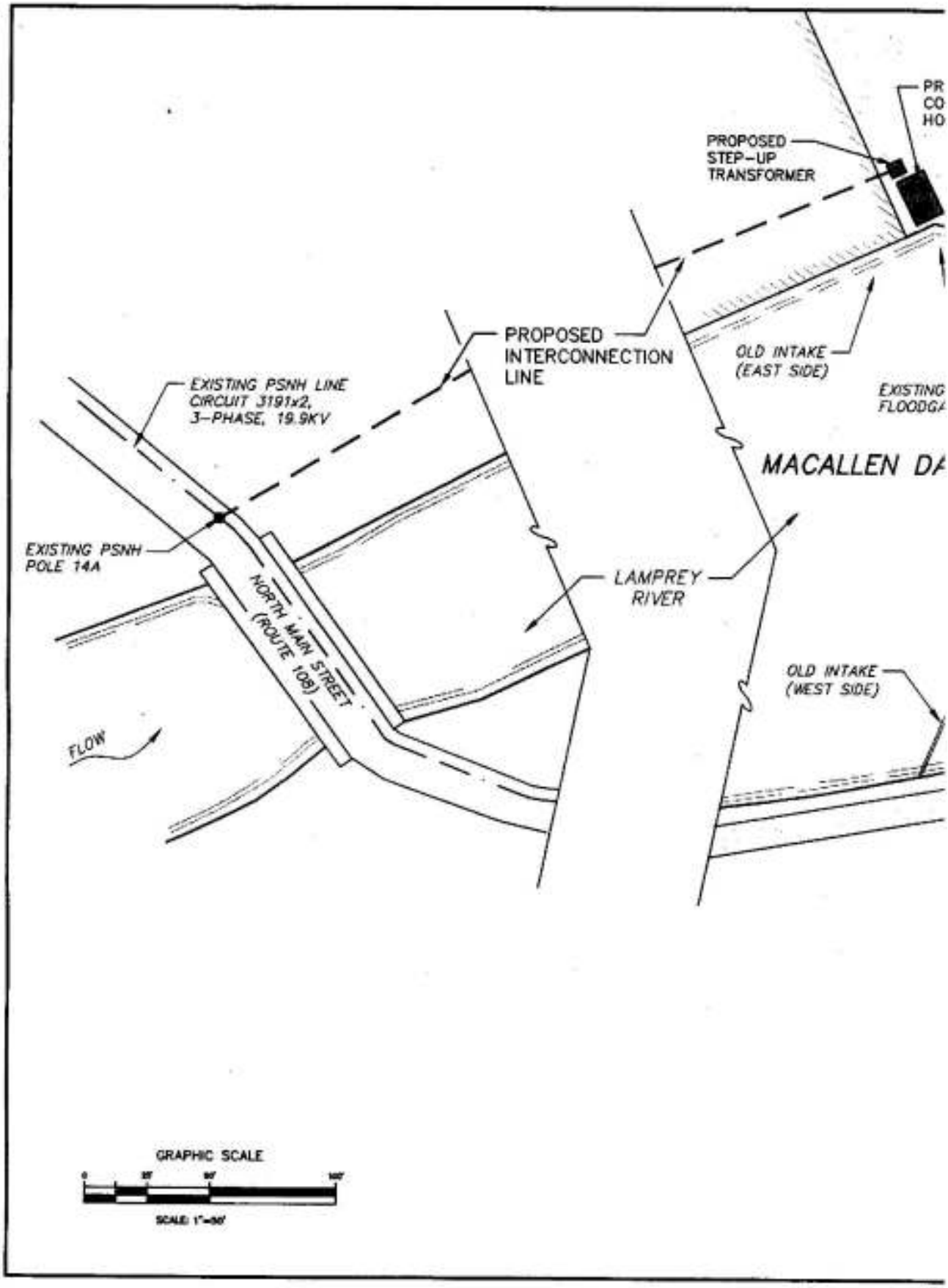
PROPOSED REDEVELOPMENT PLAN
FOR THE
MACALLEN DAM PROJECT
NEWMARKET, NH

PROJECT MAP

DATE: 7/16/99 SCALE: 1=2000'

GRAPHIC SCALE

SCALE 1" = 2000'


PROPOSED
STEP-UP
TRANSFORMER
PROPOSED
INTERCONNECTION
LINE
OLD INTAKE
(EAST SIDE)
EXISTING PSNH LINE
CIRCUIT 3191x2,
3-PHASE, 19.9KV
MACALLEN DA
EXISTING PSNH
POLE 14A
NORTH MAIN STREET
(ROUTE 108)
LAMPREY
RIVER
OLD INTAKE
(WEST SIDE)
FLOW
GRAPHIC SCALE

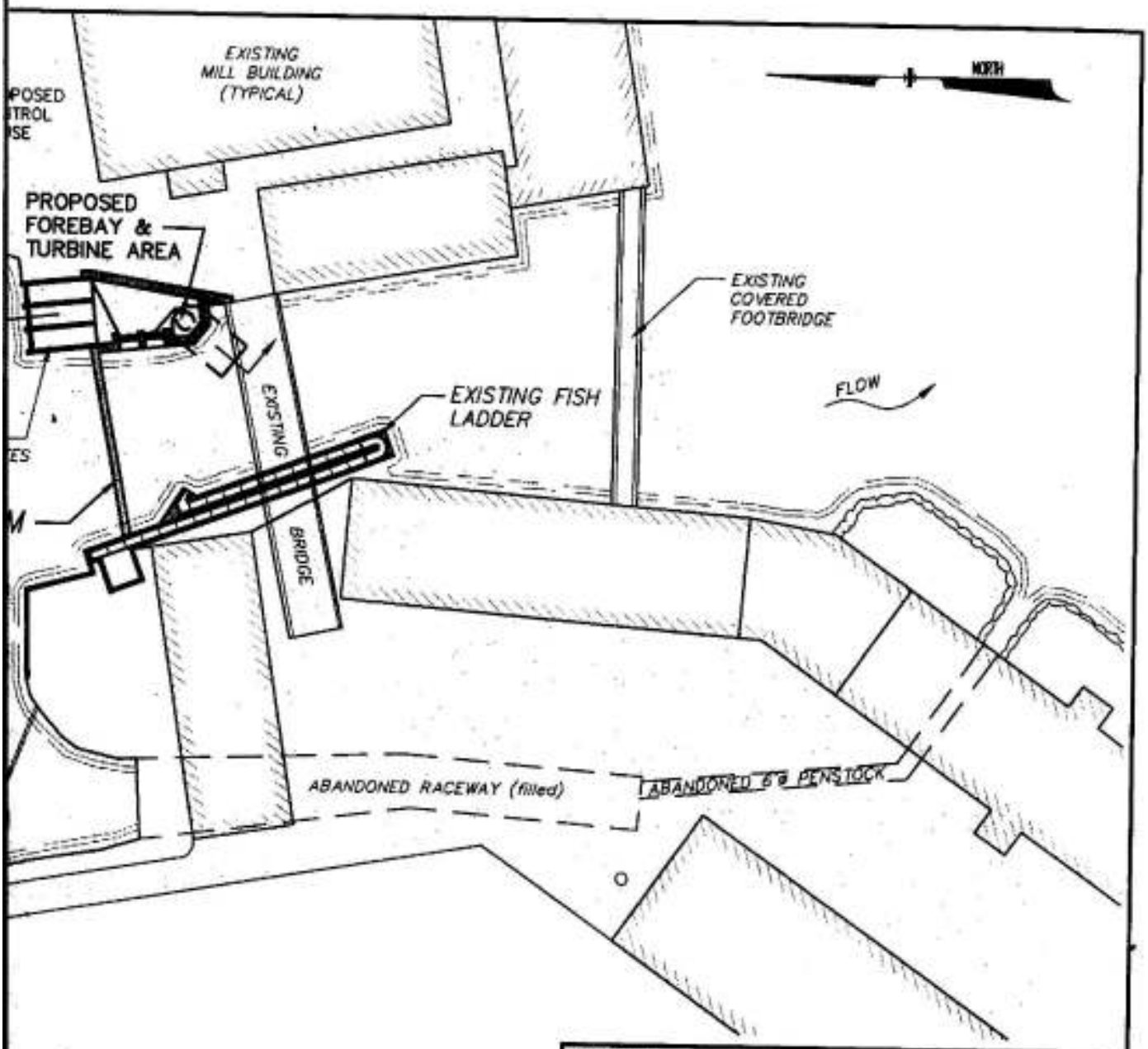


EXHIBIT 4

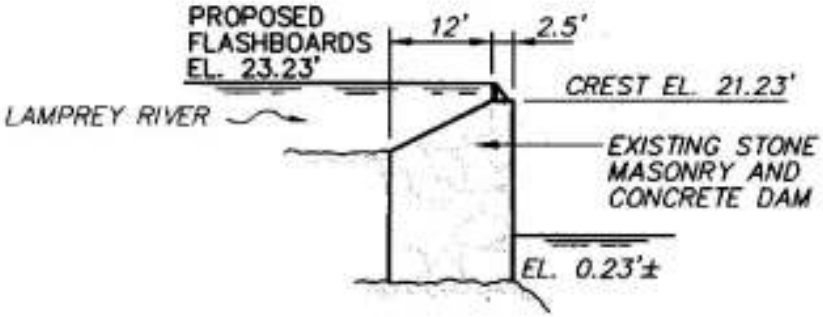
SHEET: 2 OF 4

PROPOSED REDEVELOPMENT PLAN
FOR THE
MACALLEN DAM PROJECT
NEWMARKET, NH

PROJECT SITE PLAN

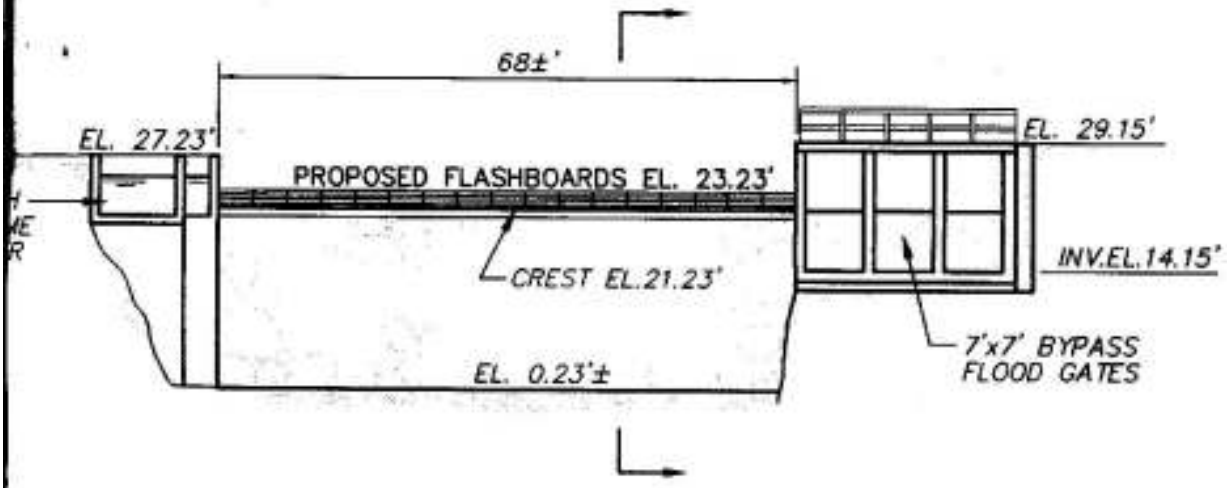
DATE: 7/16/99

SCALE: 1"= 50'



SECTION
SCALE: 1" = 20'

EXISTING
FISH &
FISH LADD



DOWNSTREAM ELEVATION

SCALE: 1" = 20'

GRAPHIC SCALE

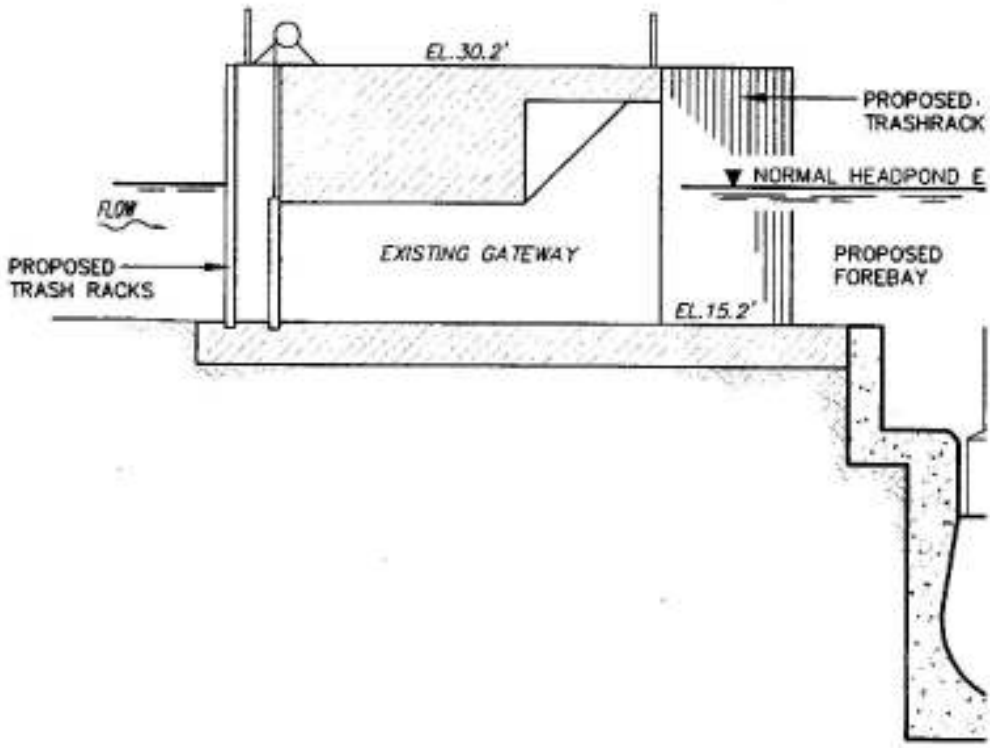
SCALE: 1"=20'

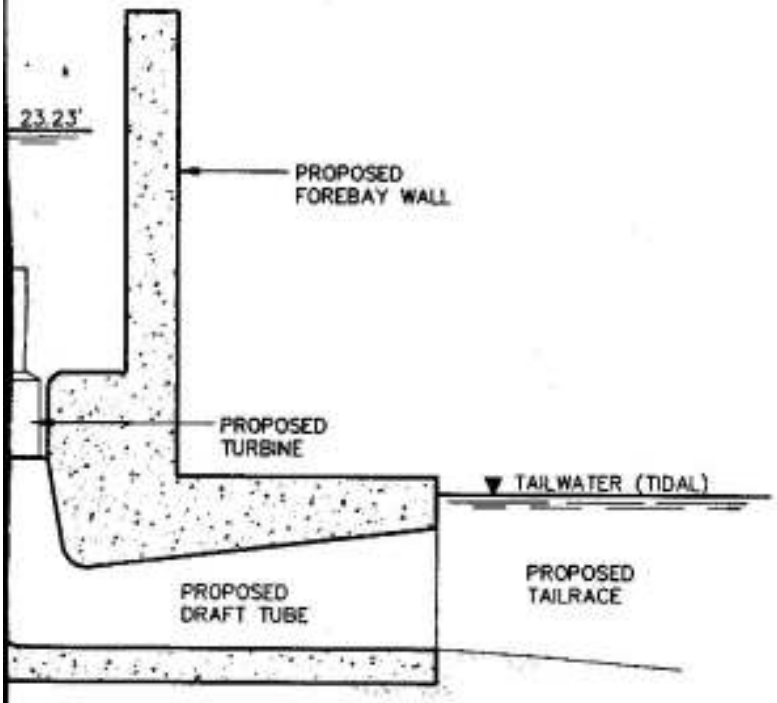
EXHIBIT 4 SHEET: 3 OF 4

PROPOSED REDEVELOPMENT PLAN
FOR THE
MACALLEN DAM PROJECT
NEWMARKET, NH

EXISTING DAM SECTIONS

DATE: 7/16/99 SCALE: 1"= 20'


EL. 30.2'
PROPOSED
TRASHRACK
NORMAL HEADPOND E
FLOW
PROPOSED
TRASH RACKS
EXISTING GATEWAY
PROPOSED
FOREBAY
EL. 15.2'



GRAPHIC SCALE

SCALE: 1" = 10'

EXHIBIT 4 SHEET: 4 OF 4

PROPOSED REDEVELOPMENT PLAN
FOR THE
MACALLEN DAM PROJECT
NEWMARKET, NH

POWERHOUSE SECTION

DATE: 7/16/99 SCALE: 1"= 10'

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

NOTICE OF APPLICATION ACCEPTED FOR FILING
AND SOLICITING MOTIONS TO INTERVENE AND PROTESTS

(January 11, 2000)

Take notice that the following hydroelectric application has been filed with the Commission and is available for public inspection:

a. Type of Application: Preliminary Permit

b. Project No.: P-11823-000

c. Date filed: September 27, 1999

d. Applicant: Town of Newmarket, New Hampshire

e. Name of Project: Macallen Dam Project

f. Location: At Macallen Dam, on the Lamprey River, near the Town of Newmarket, Rockingham County, New Hampshire.

g. Filed Pursuant to: Federal Power Act 16 U.S.C. §§791 (a) - 825(r)

h. Applicant Contact: Mr. John R. Lavigne, Jr., SFC Engineering Partnership, Inc., 25 Sundial Avenue, Suite 205W, Manchester, NH 03103, (603) 647-8700

i. FERC Contact: Michael Spencer, Michael.Spencer@FERC.fed.us, (202) 219-2846.

j. Deadline for filing motions to intervene and protest: 60 days from the issuance date of this notice.

All documents (original and eight copies) should be filed with: David P. Boergers, Secretary, Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426.

The Commission's Rules and Practice and Procedure require all intervenors filing documents with the Commission to serve a copy of that document on each person whose name appears on the official service list for the project. Further, if an intervenor files comments or documents with the Commission relating to the merits of an issue that may affect the responsibilities of a particular resource agency, they must also serve a copy of the document on that resource agency.

k. Description of Project: The proposed project would consist of the following: (1) the existing 27-foot-high masonry Macallen Dam with proposed 24-inch-high flashboards; (2) the existing reservoir would be increased to 140 acres surface area and 740 acre-feet storage capacity; (3) a proposed forebay containing one generating unit with a total capacity of 600 kW and an estimated average annual generation of 2.3 GWh; (4) a control house with transformer; and (5) a 300-foot-long transmission line.

l. Locations of the application: A copy of the application is available for inspection and reproduction at the Commission's Public Reference and Files Maintenance Branch, located at 888 First Street, N.E., Room 2A, Washington, D.C. 20426, or by calling (202) 219-1371. This filing may be viewed on the web at http://www.ferc.fed.us/online/rims.htm (Call (202) 208-2222 for assistance). A copy is also available for inspection and reproduction at the address in item h above.

Preliminary Permit -- Anyone desiring to file a competing application for preliminary permit for a proposed project must submit the competing application itself, or a notice of intent to file such an application, to the Commission on or before the specified comment date for the particular application (see 18 CFR 4.36). Submission of a timely notice of intent allows an interested person to file the competing preliminary permit application no later than 30 days after the specified comment date for the particular application. A competing preliminary permit application must conform with 18 CFR 4.30(b) and 4.36.

Preliminary Permit -- Any qualified development applicant desiring to file a competing development application must submit to the Commission, on or before a specified comment date for the particular application, either a competing development application or a notice of intent to file such an application. Submission of a timely notice of intent to file a development application allows an interested person to file the competing application no later than 120 days after the specified comment date for the particular application. A competing license application must conform with 18 CFR 4.30(b) and 4.36.

Notice of intent -- A notice of intent must specify the exact name, business address, and telephone number of the prospective applicant, and must include an unequivocal statement of intent to submit, if such an application may be filed, either a preliminary permit application or a development application (specify which type of application). A notice of intent must be served on the applicant(s) named in this public notice.

Proposed Scope of Studies under Permit -- A preliminary permit, if issued, does not authorize construction. The term of the proposed preliminary permit would be 36 months. The work proposed under the preliminary permit would include economic analysis, preparation of preliminary engineering plans, and a study of environmental impacts. Based on the results of these studies, the Applicant would decide whether to proceed with the preparation of a development application to construct and operate the project.

Comments, Protests, or Motions to Intervene -- Anyone may submit comments, a protest, or a motion to intervene in accordance with the requirements of Rules of Practice and Procedure, 18 CFR 385.210, .211, .214. In determining the appropriate action to take, the Commission will consider all protests or other comments filed, but only those who file a motion to intervene in accordance with the Commission's Rules may become a party to the proceeding. Any comments, protests, or motions to intervene must be received on or before the specified comment date for the particular application.

Filing and Service of Responsive Documents -- Any filings must bear in all capital letters the title "COMMENTS", "NOTICE OF INTENT TO FILE COMPETING APPLICATION", "COMPETING APPLICATION", "PROTEST", "MOTION TO INTERVENE", as applicable, and the Project Number of the particular application to which the filing refers. Any of the above-named documents must be filed by providing the original and the number of copies provided by the Commission's regulations to: The Secretary, Federal Energy Regulatory Commission, 888 First Street, N.E., Washington, D.C. 20426. An additional copy must be sent to Director, Division of Project Review, Federal Energy Regulatory Commission, at the above-mentioned address. A copy of any notice of intent, competing application or motion to intervene must also be served upon each representative of the Applicant specified in the particular application.

Agency Comments -- Federal, state, and local agencies are invited to file comments on the described application. A copy of the application may be obtained by agencies directly from the Applicant. If an agency does not file comments within the time specified for filing comments, it will be presumed to have no comments. One copy of an agency's comments must also be sent to the Applicant's representatives.

Linwood A. Watson, Jr.
Acting Secretary

ORIGINAL

New Hampshire
Fish and Game Department

2 Hazen Drive, Concord, NH 03301-6500
Headquarters: (603) 271-3421
Web site: http://www.wildlife.state.nh.us

Wayne E. Vetter
Executive Director

FILED
OFFICE OF THE SECRETARY
00 FEB 23 PM 4:22
FEDERAL ENERGY
REGULATORY
COMMISSION

TDD Access: Relay NH 1-800-735-2964
FAX (603) 271-1438
E-mail: info@wildlife.state.nh.us

February 17, 2000

David Boergers, Secretary
Federal Energy Regulatory Commission
888 First St. NE
Washington DC 20426

REF. NH Dam #177.01
Macallen Dam
Lamprey River
Newmarket NH
FERC #P-11823

PROTEST

Dear Secretary Boergers:

The New Hampshire Fish and Game Department is providing the following comments in the form of a Protest regarding the Application for a Preliminary Permit for the Macallen Dam. The Department is providing comments in support of the Protest pursuant to NH RSA 206:9, and 206:10, and FERC rules 18 CFR 385.210, .211, and .214.

The Town of Newmarket is proposing to study the feasibility of developing hydro at the existing Macallen Dam for which they recently secured ownership. The Town is proposingamong other things to install one generating unit and 24" of flashboards to the top of the spillway.

In 1971 the Fish and Game Department constructed a Denil fish ladder at the dam as part of anadromous fish restoration for the Great Bay watershed. The construction and sufficient flows to operate the ladder was secured in an agreement with the dam owner (copy enclosed). Although ownership of the dam has changed since 1971, the Department asserts that the rights spelled out in the Agreement are still ineffect and must be honored. The fish ladder was originally designed for river herring followed by American shad and salmon. Table 1.shows the number of river herring,

000228-0138-3

RECEIVED
FEB 25 2000

and American shad that have utilized the fish ladder from 1972 through 1999 (copy enclosed).

In 1985 the Fish and Game Commission, which sets policy for the Fish and Game Department, unanimously adopted a resolution that opposes the siting of a hydropower facility at the Macallen Dam. The policy was also adopted in resolution form by the New Hampshire House of Representatives and Senate and forwarded to the Federal Energy Regulatory Commission (FERC).

In 1985 the Fish and Game Department consulted with an applicant for a FERC hydro license at Macallen Dam (FERC #6602). During the consultation period the Department determined that the installation of hydro would adversely affect fish passage. Consequently, the Department protested the application in a letter dated 2-12-86 to then FERC Secretary Kenneth Plumb (copy enclosed).

The Preliminary Permit Notice states that the applicant is considering the installation of 24" of flashboards. During the Department's earlier consultation in 1985 and 1986, opposition arose because of the impacts of additional water on wetlands, agriculture, and conservation lands. Raising the impoundment would also reduce free flowing stream habitats. Additionally, the installation of flashboards will render the fish ladder inoperable as a swim-through facility it was originally designed for. Installation of flashboards as part of the hydro operation at the Cocheco Falls Dam (FERC #4718), where the Department has operated a fish ladder since 1972, has prevented its operation as a swim-through facility. The Department has determined that the additional head of water created by the flashboards has increased the flow into the fish ladder and prevented anadromous fish from exiting the ladder to the river. This problem has been brought to FERC's attention in a Petition filed by the state of New Hampshire in 1995. In response to the Petition FERC has determined in a Preliminary Analysis and Draft Environmental Assessment that the hydro licensee incur the cost of modifying our fish ladder to make it swim-through. Undoubtedly, the installation of flashboards at the Macallen Dam will have

an identical and unacceptable impact on the operation of this Department's fish ladder.

Another significant adverse impact to anadromous fish from the proposed hydro project would be attraction of anadromous fish to the hydro's tailrace and not to the fish ladder entrance. The false attraction flows from the tailrace would result in unacceptable delays in anadromous fish migration to upstream spawning habitats.

The Fish and Game Department would like to note that the Preliminary Permit Applicant is the Town of Newmarket. As stated before, the Town recently secured ownership of the Macallen Dam. However, in correspondence to FERC Secretary Kenneth Plumb dated 2-26-86, the Town of Newmarket stated that there is no demonstrated need for the hydro project (FERC #6602) and that the hydro proposal has the potential of adversely impacting anadromous fish and wildlife (copy enclosed).

Based on cumulative impacts, which would have an adverse impact on anadromous fish and wildlife resources of the Lamprey River, the Fish and Game Department opposes any development of hydro at the Macallen Dam and recommends that the Town of Newmarket withdraw their Preliminary Permit application. Also, no amount of mitigation would make the hydro project acceptable.

If you have any questions please contact Ecologist William Ingham Jr. at (603) 271-0453.

Sincerely

Wayne E. Vetter

Wayne E. Vetter
Executive Director

WEV/WCI

Enclosures
cc: William Ingham Jr. NHFGD
John Nelson NHFGD
Michael Bartlett USFWS
Richard Moquin NH Fish and Game Com.
Director, Div. Of Project Rev. FERC
John Lavigne SFC Engineering

2091 384

AGREEMENT

This indenture, made this 17th day of August 1971, between and by the PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, Grantor, and the STATE OF NEW HAMPSHIRE by the Director of the FISH AND GAME DEPARTMENT, Grantee.

For consideration paid, the Grantor does hereby grant permission to the Grantee to enter upon and to construct, maintain, and to have exclusive control of a fish ladder and weirs at the Lamprey River dam, being the first dam upstream from tidewater in the Town of Newmarket, and to maintain water upon so much of the Grantor's land as will be flooded when the fishway and weirs are holding water to full capacity.

Said fish ladder will have an upstream inlet depth not greater than 2'-6" below the crest of the dam and an interior width of 3'-0".

It is agreed that operation of the fishway will be limited to the use of water that is in excess to the Grantor's needs or production purposes.

It is further agreed that the Grantor shall not be liable in any way for:

1) Injuries to any person or damage to property in connection with the construction, maintenance, or use of said fish ladder.

2) Any damage caused by the failure of said fish ladder.

3) Any costs of construction or maintaining the fish ladder or its parts.

It is further understood and agreed that the Grantor grants only those rights which are herein expressly provided for and no others.

* * * * * * * * * * *

IN WITNESS WHEREOF, the said parties have hereunto set their hands interchangeably the day and year first written above.

(Executed in duplicate)

STATE OF NEW HAMPSHIRE
FISH AND GAME DEPARTMENT

Director

PUBLIC SERVICE COMPANY OF N. H.

By: (Title)

APPROVED AS TO FORM AND EXECUTION

Table 1. Numbers of river herring returning to fishways on coastal New Hampshire rivers from 1972-1999.

YEAR	COCHECO RIVER	EXETER RIVER	OYSTER RIVER	LAMPREY RIVER	TAYLOR RIVER	WINNICUT RIVER
1972				2,528		*
1973				1,380		*
1974				1,627		*
1975		2,639		2,882		*
1976	9,500		11,777	3,951	450,000	*
1977	29,500		359	11,256		2,700**
1978	1,925	205	419	20,461	168,256	3,229**
1979	586	186	496	23,747	375,302	2,410**
1980	7,713	2,516	2,921	26,512	205,420	4,393**
1981	6,559	15,626	5,099	50,226	94,060	2,316**
1982	4,129	542	6,563	66,189	126,182	2,500**
1983	968	1	8,866	54,546	151,100	*
1984	477		5,179	40,213	45,600	*
1985	974		4,116	54,365	108,201	*
1986	2,612	1,125	93,024	46,623	117,000	1,000**
1987	3,557	220	57,745	45,895	63,514	*
1988	3,915		73,866	31,897	30,297	*
1989	18,455		38,925	26,149	41,395	*
1990	31,697		154,588	25,457	27,210	*
1991	25,753	313	151,975	29,871	46,392	*
1992	72,491	537	157,024	16,511	49,108	*
1993	40,372	270	73,788	25,289	84,859	*
1994	33,140	*	91,974	14,119	42,164	*
1995	79,385	592	82,895	15,904	14,757	*
1996	32,767	248	82,362	11,200	10,113	*
1997	31,182	1,302	57,920	13,788	20,420	*
1998	25,277	392	85,116	15,947	11,979	219

* - Due to damage to the fish trap, fishway became a swim through operation.

* - Fishway unable to pass fish until modifications in 1997.

** - Fish netted and hand passed over Winnicut River dam.

Bill/File

STATE OF NEW HAMPSHIRE

FISH AND GAME DEPARTMENT

ALLEN F. CRABTREE, III
EXECUTIVE DIRECTOR

34 Bridge Street
Concord, N.H. 03301
(603) 271-3421

February 12, 1986

Kenneth Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol St., NE
Washington, DC 20426

REF. N.H. Dam #177.01
Macallen Dam
Lamprey River
Newmarket, N.H.
FERC PROJECT NO.: 6958

PROTEST AND COMMENTS

Dear Secretary Plumb:

Thank you for the opportunity to provide Protest and Comments regarding the Notice of Application for a Minor License filed with your commission for the above referenced project. The New Hampshire Fish and Game Department is providing Protest and Comments pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.) and New Hampshire RSA 206:9 and 206:10. The Fish and Game Department also provided to you Protest and Comments and a Motion to Intervene regarding a competing application for a Minor License (FERC #6602) dated November 14, 1985, and November 15, 1985, respectively.

The New Hampshire Fish and Game Department has determined that no hydro facility of any design or operating mode should be retrofitted or constructed at the Macallen Dam as it would interfere with the efficient operation of an already existing fish ladder and an ongoing and successful anadromous fish restoration program to the Lamprey River. This determination is based on the fact that the existing fish ladder has been efficiently operating since 1971 in the absence of a hydro facility and that the information and mitigation supplied by the applicant to this department and the FERC is conceptual and not based on fact or actual operating conditions at any other hydro facilities where a fish ladder is located and operated. Also, the Fish and Game Department has a binding legal agreement with the Public Service Co. of New Hampshire for use of water at the dam for the operation of our fish ladder.

Since this agreement (enclosure) was signed in 1971, it had been more than satisfactory. This agreement will not be amended or abrogated.

In consideration of the above, the New Hampshire Fish and Game Commission on April 17, 1985, unanimously adopted the following resolution:

> WHEREAS, the State of New Hampshire lacks a balanced and comprehensive river resource protection and hydro power energy development plan for the long range use of its river resources which will reduce the loss of important river resources while encouraging hydro power development projects which minimize negative environmental impact, and
>
> WHEREAS, such a plan would be in the best interest of the people of the State of New Hampshire which has undertaken anadromous, shad, alewife and salmonid restoration and introduction programs in the coastal Cocheco and Lamprey rivers since 1969 with considerable investment, and
>
> WHEREAS, these rivers possess highly significant composite resource values as revealed by demonstrated public use and public preference with the Lamprey River being recognized as the state's most significant river for all anadromous species, and
>
> WHEREAS, the success of these programs have the potential to contribute significantly to the recreational usage and resulting economic well being of the seacoast region and the State of New Hampshire in general, and
>
> WHEREAS, it has been demonstrated that a negative environmental impact results when operating hydro power facilities during upstream and downstream anadromous fish migrations, and
>
> WHEREAS, the proposed siting of hydro power generating facilities at the Macallen Dam in Newmarket and the operation of the Cocheco Falls dam hydro power facility in Dover would cause considerable negative environmental impact and do not represent the best use of these river resources, and
>
> WHEREAS, the economic viability of these hydro development projects is questionable and is based on ill conceived state and federal financial incentives which benefit the developer and not the consumer,
>
> THEREFORE, BE IT RESOLVED that by the House of Representatives and Senate in General Court convened opposes any further hydro power activities that would compromise the composite resource value of these rivers;
>
> That the general court opposes the expansion of the hydropower facility located in Dover; and
>
> That the general court opposes the siting of a hydropower facility in Newmarket.

If the FERC in its deliberations determines that the estimated 2,300,000 kilowatt-hours of electricity proposed to be generated by this hydro facility is in the greater public interest than the ongoing anadromous fish programs and issues a

license, the Fish and Game Strongly recommends that the following be included as Articles to that license:

1. The Licensee incur any and all costs associated with design and construction changes to the fish ladder.

2. The Licensee provide a schedule of construction to be reviewed by the New Hampshire Fish and Game Department. Such construction work will not interfere with upstream or downstream passage of anadromous fish or spawning by any fish species in the project area.

3. 'The Licensee provide vehicular access at all times to the fish ladder by representatives of the New Hampshire Fish and Game Department.

4. Design changes to the fish ladder be reviewed by Benedetto Rizzo, U.S. Fish and Wildlife Service Hydraulic Engineer, and incorporated by the Licensee into the plans before construction commences (enclosure dated 7-29-85).

5. The Licensee construct, maintain and operate efficient downstream fish passage facilities at the project capable of safely passing adult and juvenile anadromous fish. The facility design must be reviewed by Mr. Rizzo and must be incorporated before construction commences.

6. The dates of operation of downstream and upstream fish passage facilities will be determined by the New Hampshire Fish and Game Dept.

7. Flows necessary to operate fish passage facilities will take precedence over flows utilized by the hydro operation.

8. The Licensee conduct studies to insure that tailrace flows do not interfere with upstream migrations of anadromous fish.

9. The Licensee provide an instantaneous flow of 105 CFS or inflow, whichever is less, from the project.

10. The Licensee assume financial responsibility for damage to the fish ladder during construction or for damage resulting from operation of the hydro facility.

11. All conditions of the license shall be conveyed by sale or lease of the project in order to protect the fish and wildlife resources.

12. The Licensee provide a means for monitoring flows to all structures within the project.

The description of the project in the Notice of Application states that the project would consist of new 2 foot high flashboards at the dam. The applicant's original and amended applications do not address the impact to existing fish and

wildlife habitat in the impoundment, particularly wetlands, from an increase in water level.

Again, the New Hampshire Fish and Game Department has reviewed the application for Minor Licnese and has determined that no hydro facility of any design or operating mode should be constructed at the Macallen Dam.

Sincerely yours,

Allen F. Crabtree, III
Executive Director

WCI/AFC/rjj
cc: John Webster
Fred Springer
Thomas Bigford
John Monson
Enc.

State of New Hampshire

HOUSE OF REPRESENTATIVES

CONCORD

COMMITTEE ON FISH AND GAME

17701

28 June 1985

Mr. Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D.C. 20426

Dear Mr. Plumb:

We, the undersigned members of the New Hampshire House of Representatives Committee on Fish and Game, wish to bring to your attention our concerns with several proposed hydroelectric power projects in our state. New Hampshire, with its abundant streams and rivers, has experienced a boom recently in the development of low-head hydropower facilities.

The committee understands that hydropower can make a contribution to our electrical needs, and that at many sites it can be a relatively benign source of energy. But we also recognize that in certain instances it can create severe and unmitigatable impacts on fish, wildlife, agricultural, and recreational resources, and in those instances the losses may far outweigh the benefits.

At present, we believe that New Hampshire is faced with at least three such projects. First, the Sewalls Falls Hydroelectric Project (FERC #7216) in Concord would destroy several miles of free-flowing river, thereby eliminating a very excellent cold-water fishery, jeopardizing the restoration of Atlantic salmon to the Merrimack River, and threatening agricultural operations upstream of the proposed dam. The New Hampshire Fish and Game Department has taken a very strong position against this project, and we concur. Further, we endorse the Fish and Game Commission's resolution on Sewalls Falls, adopted on 17 April and enclosed herein.

On our seacoast, there are two projects which threaten the successful restoration of anadromous fish to important coastal rivers. We believe, after first-hand observation and study, that the siting of hydropower facilities at the Macallen Dam (FERC #8958) on the Lamprey River in Newmarket and the expanded operation of the Cocheco Falls Dam (FERC #4718) hydropower facility on the Cocheco River in Dover would present sustained and unavoidable negative impacts on the restoration of anadromous fish to these rivers. And, given the negligible amount of power that would be produced by these facilities, we believe that the

best interest of the State of New Hampshire would be served if they were not constructed or expanded.

We appreciate this opportunity to express our concerns about, and opposition to, these facilities, and we hope that they will be of value in your deliberations over the license applications for these three projects.

Sincerely,

Members, House of Representatives,
Committee on Fish and Game

by Marylou Lewis

WHEREAS, the State of New Hamps[illegible] balanced and comprehensive river resource protection and hydro power energy development plan for the long range use of its river resources which will reduce the loss of important river resources while encouraging hydro power development projects which minimize negative environmental impact, and

WHEREAS, such a plan would be in the best interest of the people of the State of New Hampshire which has undertaken anadromous, shad, alewife and salmonid restoration and introduction programs in the coastal Cocheco and Lamprey rivers since 1969 with considerable investment, and

WHEREAS, these rivers possess highly significant composite resource values as revealed by demonstrated public use and public preference with the Lamprey River being recognized as the state's most significant river for all anadromous species, and

WHEREAS, the success of these programs have the potential to contribute significantly to the recreational usage and resulting economic well being of the seacoast region and the State of New Hampshire in general, and

WHEREAS, it has been demonstrated that a negative environmental impact results when operating hydro power facilities during upstream and downstream anadromous fish migrations, and

WHEREAS, the proposed siting of hydro power generating facilities at the Macallen Dam in Newmarket and the operation of the Cocheco Falls dam hydro power facility in Dover would cause considerable negative environmental impact and do not represent the best use of these river resources, and

WHEREAS, the economic viability of these hydro development projects is questionable and is based on ill conceived state and federal financial incentives which benefit the developer and not the consumer,

THEREFORE, BE IT RESOLVED that by the House of Representatives and Senate in General Court convened opposes any further hydro power activities that would compromise the composite resource value of these rivers;

That the general court opposes the expansion of the hydropower facility located in Dover; and

That the general court opposes the siting of a hydropower facility in Newmarket.

OFFICE OF
THE SELECTMEN

NEWMARKET,
NEW HAMPSHIRE 03857

February 26, 1986

Mr. Kenneth Plumb, Director
Federal Energy Regulatory Agency
825 N. Capital Street NE
Washington, DC 20426

RE: MOTION TO INTERVENE

PROJECT # 8958-000

NH DAM # 177-01

APPLICANT: HYDRO DEVELPOMENT INCORPORATED

APPLICATION FILED ON FEBRUARY 15, 1985

WATER BODY; LAMPREY RIVER

DAM: MACALLEN

COMMENTS ALSO APPLY TO PROJECT # 6602-003, FILED JANUARY 28, 1985.

Dear Mr. Plumb:

We, the Newmarket Board of Selectmen, are filing this motion because we are concerned that the following issues have not been investigated thoroughly:

1. It is our opinion there has not been demostrated a strong need for this hydro project. According to the application it would serve very few homes, while interupting the delicate ecology of the region, and particularly the aquatic life forms of the river.

2. There has not been any impact study on the effects of the project on the water system basin wide. Because there are other applications for projects on this river, this should be done before a license is issued.

3. Presently, there are andromous fisheries restoration and introduction

programs being undertaken by federal, state, and private groups. It is very important for the local economy and for recreational opportunities and should not be placed in jeopardy by such a small hydro project without complete assurances and guarantees it will not have an adverse effect.

4. It has not been demonstrated there will not be an adverse effect on the salmon migration. Since this type of project has no historical precedent to show the effects, there is no sound, proved method to demostrate beyond a shadow of a doubt there will not be an adverse effect. All the developer has used for "proof" to date is theoretical data to substatiate his case. However, if his data proves incorrect, there will be no way to reverse the damage to the salmon population.

5. The developer has not addressed the issue of septic systems being impacted from the increased water table.

6. Recreational opportunities will be diminished if the salmon population is effected by the project. The Town has just completed a Waterfront Project, including a launch, in part with federal conservation funds. Consequently, this would effect the local economy. For instance, a restaurant opened in this adjacent area because of the increased interest in the waterfront.

7. The developer has not addressed long term maintenance of the equipment and dam. This creates concern. In the scenario that the project did create adverse ecological problems, the project could simply be abandoned.

8. We also think that it has not been demonstrated that wild life that relies on this native habitat will not be impacted. The community is in on of the highest growth areas of the nation. Soon

there will be no place for the animals to go to if a habitat is destroyed.

Please keep us informed concerning the status of this project. We are acutely concerned there is a possibility our unique resources will be impacted with no return for the community.

Respectfully,

Newmarket Board of Selectmen

JoAnne Hauschel, Chairman
Albert Caswell, Jr.
Ronald S. Coker

C

ORIGINAL

Coastal Conservation Assocation of New Hampshire

Post Office Box 242 • Center Barnstead, NH 03225
Phone: (603) 776-3474 • Fax: (603) 776-2992

OFFICE OF THE SECRETARY
00 MAR -3 PM 2:54
FEDERAL ENERGY REGULATORY COMMISSION

February 28, 2000

David Boergers, Secretary
Federal Energy Regulatory Commission
888 First St.,
Washington, DC 20426

REF: NH Dam #177.01
NE Macallen Dam
Lamprey River, Newmarket,NH
FERC #P-11823

PROTEST

Dear Secretary Boergers:

The Coastal Conservation Association is providing the following comments in the form of a Protest regarding the application for a Preliminary Permit for the Macallen Dam. Our protest is pursuant to FERC rules 18 CFR 385.210, 211 and 214.

The Town of Newmarket has proposed a study of the feasibility of developing a hydro facility at the existing Macallen Dam to which the Town recently secured ownership. The Town is proposing, among other things, to install a generating unit and 24" tall flashboards to the top of the spillway.

New Hampshire Fish & Game Department constructed a fish ladder at Macallen Dam in 1971 as part of the ongoing anadromous fish restoration program for the Great Bay area of the state. Construction permits and an agreement for sufficient flows to operate the fish ladder were secured in agreement with the then dam owner. Though ownership of the dam has changed, the Department asserts that the rights under that Agreement are still in effect and must be honored.

The fish ladder is designed for River Herring, Shad and Atlantic Salmon. In 1985 the Fish & Game Commission which sets policy for New Hampshire Fish & Game Department, unanimously adopted a resolution opposing the siting of a hydroelectric facility at Macallen Dam. That resolution was also adopted by the New Hampshire House of Representatives and Senate, then forwarded to FERC. On February 17, 2000 the New Hampshire Fish & Game Dept. in a letter of protest, reaffirmed their opposition to said hydroelectric facility being constructed.

The proposed 24" flashboards at the Macallen Dam would render the existing fish ladder inoperable for passage of Shad, River Herring or Atlantic Salmon. Shad and River Herring species are declared over fished by the

AJ
FERC DOCKETED
MAR 3 - 2000

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Dedicated to Conserving New Hampshire's Marine Resources

National Marine Fisheries Service(NMFS) and extensive restoration projects are underway by the combined Northeastern States. Such a project is underway in New Hampshire on the Lamprey River. In 1999 the Interior Department budgeted significant funding to constructed a fish ladder for those species at the next upriver barrier; Wiswell Dam. Construction of that facility would begin in 2000. The proposed flashboards would effectively block Shad or River Herring from reaching the Wiswell Dam fish ladder.

The Coastal Conservation Association is a nonprofit, 501c3 organization with chapters in fifteen coastal states from Texas to Maine consisting of more than 73,000 members. We are dedicated to the restoration and protection of coastal marine species and habitat both inshore and offshore.

Based on cumulative impacts, which would adversely effect anadromous fish and wildlife resources of the Lamprey River system, Coastal Conservation Association opposes any development at Macallen Dam of a hydroelectric facility and we earnestly recommend the application be withdrawn. If you have any questions please contact the undersigned.

Sincerely,

William D. Hubbard, President
Coastal Conservation Association

cc: Wayne E. Vetter, Ex.Director, NH Fish & Game Dept.
Richard Moquin, Chairman, NH Fish & Game Commission
John I. Nelson, Chief, NH Div. Marine Fisheries
William Ingham, Jr., NH Fish & Game Dept.
Michael J. Bartlett, US Fish & Wildlife Service
Dir. Div. of Project Review, FERC
John Lavigne, SFC Engineering

ORIGINAL

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

MAR 3 2000

David Boergers, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

RE: FERC Project # 11823-000
Macallen Dam Project, Newmarket, NH

COMMENTS

Dear Secretary Boergers:

The National Marine Fisheries Service (NMFS) is responding to the Notice of Application for a preliminary permit dated January 11, 2000 for project # P-11823-000 submitted by the Town of Newmarket, NH. NMFS is providing these comments and requesting continued involvement in this process pursuant to 18 CFR 385.210, .211 and .214.

The Town of Newmarket is proposing to amend the existing 27-foot-high Macallen Dam on the Lamprey River with the installation of 24-inch-high flashboards to create a 600 kw generating facility. The project will increase the existing reservoir to 140 acres surface area and 740 acre-feet storage capacity.

In 1996, the U.S. Congress, understanding the importance of sustainable fisheries to coastal states such as New Hampshire, and recognizing the dependency of fish on their coastal and riverine habitats, reauthorized the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) with amendments aimed at promoting and maintaining healthy habitats for managed fish species. Section 303(a)(7) of the MSFCMA required that the fishery management councils designate essential fish habitat (EFH) for all life stages of all federally managed species. The New England and Mid-Atlantic Fishery Management Councils and NMFS have designated EFH for 59 species in the Northeast

Section 305(b)(2) of the MSFCMA also requires federal agencies to consult with NMFS regarding all activities they fund, permit, or carry out that may adversely affect designated EFH. An adverse effect has been defined in the MSFCMA as "any impacts which reduce the quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species fecundity), site-specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

The Lamprey River has been designated as EFH for Atlantic salmon, winter flounder, Atlantic sea herring, and bluefish, with Atlantic salmon being of particular concern for this project. The

Macallen Dam establishes the head-of-tide for the Lamprey River. The Lamprey River and its tributaries have been designated as EFH for Atlantic salmon due to its historic and current accessibility and the overall importance of this river to many life stages of this anadromous species. Additionally, NMFS is concerned about the potential adverse effects to other anadromous species, such as river herring, rainbow smelt, and American shad, that pass through the State's existing Denil fish ladder to upstream spawning grounds. Construction of a hydropower facility at this location has the potential to adversely affect EFH and related species by disrupting anadromous fish passage and reducing free flowing stream habitats.

In order to comply with the requirements of the MSFCMA, the Federal Energy Regulatory Commission (FERC) must consult with NMFS on this project. Typically, consultation is initiated with NMFS' receipt of an EFH assessment that details the potential effects on EFH. The EFH assessment can be submitted as part of a draft Environmental Assessment (EA) or as a separate document. Should the applicant decide to pursue the preliminary permit, an EFH assessment will have to be submitted to NMFS to formally initiate consultation. NMFS requests participation in any meetings and copies of correspondence used to develop a scope of work for an environmental assessment or an EFH assessment.

Mandatory components of an EFH assessment include the following:

1. A description of the proposed action
2. An analysis of the effects, including cumulative effects of the proposed action on EFH, the managed species, and associated species such as major prey species, including affected life history stages
3. The FERC's views regarding the effects of the action on EFH
4. Proposed mitigation, if applicable

Other information that should be incorporated into an EFH assessment, as appropriate, includes the results of on-site inspections to evaluate the habitat, the site-specific effects of the project, the views of recognized experts on the habitat or species affected, a review of pertinent literature and related information, and an analysis of alternatives to the proposed action.

Additional information pertaining to life history and habitat requirements of the EFH species can be found in the NMFS Habitat Conservation Division web site at: www.nero.nmfs.gov/ro/doc/hcd.htm, under the topic of Guide to Essential Fish Habitat Designations.

Pursuant to section 305(b)(4)(A) of the MSFCMA, once received, NMFS will review the EFH assessment and provide the FERC with comments and EFH conservation recommendations as appropriate. NMFS' recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse impacts to EFH. Section 305(b)(4)(B) of the MSFCMA requires the FERC to provide NMFS with a detailed written response to the conservation recommendations, including a description of measures adopted by the FERC for avoiding, minimizing, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with NMFS' recommendations, the FERC must explain its reasons for not following the recommendations,

including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid minimize, mitigate, or offset such effects [50 CFR 600.920(J)].

We look forward to continued coordination on this project. Should you have any questions regarding this matter or EFH in general, please contact Mr. Lou Chiarella, EFH Coordinator, at (978) 281-9277.

Sincerely,

Peter D. Colosi

Peter D. Colosi
Assistant Regional Administrator
for Habitat Conservation

cc: John R Lavigne, SFC Engineering
25 Sundial Ave, Suite 205W
Manchester, NH 03103
William Ingham, NHFGD, Concord
Michael Bartlett, USFWS, Concord
Director, Div of Project Review, FERC
Lou Chiarella, NMFS
Eric Hutchins, NMFS

Kirsten and Hunter Brownlie
13C Piscassic Street
Newmarket, NH 03857

March 3, 2000

David Boergers
Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Dear David Boergers:

This is a letter of protest for project # P-11823-000, an application for a hydroelectric plant at the Macallen Dam located in Newmarket, New Hampshire.

As citizens in Newmarket, we are concerned about the following issues:

1) Increasing the potential for flooding upriver in residential areas on both the Lamprey River and the Piscassic River.

2) The increase in the water flow through the fish ladder could deter fish from moving upriver.

3) Downstream fish being attracted to the hydro-outflows rather than being attracted to using the ladder.

4) The potential damage to vegetation on the riverbanks and increase in erosion problems.

Thank you for your consideration.

Sincerely,

Kirsten O. Brownlie

Hunter D. Brownlie Kirsten O. Brownlie

000310-0118-3

OFFICE OF THE
TOWN ADMINISTRATOR
E-MAIL - NEWMARKET1@AOL.COM
WEBSITE - WWW.NEWMARKET-NH.COM

INCORPORATED
DECEMBER 15, 1727
CHARTER JANUARY 1, 1991

March 6, 2000

Federal Energy Regulatory Commission
ATTN: Secretary
888 First Street, NE
Washington, DC 20426

RE: Project No.: P-11823-000
Project Name: Macallen Dam Project

Dear Mr. Spencer:

Please withdraw the application for Preliminary Permit for the above-cited project from any further consideration by your agency.

Sincerely,

Alphonse Dixon/snc

Alphonse R. Dixon
Town Administrator

ARD/dml
Pc: File

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TOWN HALL
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

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In Reply Refer To: FERC #11823-000
Comments

March 7, 2000

Mr. David P. Boergers, Secretary
Federal Energy Regulatory Commission
888 First Street, N. E.
Washington, DC 20426

Dear Mr. Boergers:

This responds to your public notice, dated January 11, 2000, regarding the application for preliminary permit for the Macallen Dam Project, located on the Lamprey River in Rockingham County, New Hampshire.

In determining the environmental feasibility of this project, the applicant should devote special attention to the following areas of concern:

Fishery Resources
The Lamprey River "is recognized as the state's most important anadromous fishery because of its species diversity and habitat quality."[1] Since 1971 the New Hampshire Fish and Game Department has operated a fish ladder at the Macallen Dam (the first barrier on the river). Presently both anadromous and catadromous fish are able to pass Macallen Dam safely. Fish passage measures are scheduled for installation at Wiswall Dam, the next barrier to migrating fish, in the near future. Once Wiswall becomes passable, an additional 43 miles of spawning and rearing habitat will be available to anadromous fish.

Wild and Scenic River Status
The portion of the Lamprey River flowing through the towns of Lee and Durham was designated as a protected river under the New Hampshire Rivers Management and Protection Program in 1991. In addition, on November 12, 1996, the 11.5-mile segment of the Lamprey River from the southern Lee town line to the Piscassic River was designated a Wild and Scenic River by

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[1]National Park Service, U.S. Department of the Interior. *1995 Lamprey Wild and Scenic River Study Draft Report*. North Atlantic Regional Office, Boston.

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Congress. The designation was the culmination of a concerted effort by the communities of Lee, Durham, and Newmarket, in recognition of the Lamprey River's unique resources (including a diverse mussel community and healthy runs of diadromous fish). The implications of the permit application on this important designation will be discussed in depth by the National Park Service under separate cover.

Previous Hydro Proposals

In the early 1980's, two parties investigated the possibility of developing Macallen Dam for hydroelectricity. Those proposals were similar to the one now before the Commission (including the addition of 2-ft. flashboards). At the time, state agencies, the state legislature, local landowners, the Lamprey River Watershed Association, Salmon Unlimited and the Towns of Newmarket and Durham all had major concerns with the impact that adding hydro generation and raising the impoundment would have on the surrounding aquatic and riparian resources. Some of the issues identified in the previous licensing attempts include:

- Tailrace flows would compete with ladder flows for attracting upstream migrants.
- The increased impoundment elevations would necessitate modifying the ladder exit
- The intake to the turbine would have to be screened and a downstream bypass facility constructed to minimize entrainment of outmigrants.
- Flashboards would: (1) inundate up to 650-ft. of free-flowing habitat; (2) impact 24 acres of wetlands; (3) flood 5-7 acres of agricultural land; and (4) reduce waterfront property of local landowners.

The Commission issued a draft Environmental Assessment for the two license applications on March 7, 1988. Staff determined that increased water turbidity, soil erosion, inundation of wetlands and agricultural land, and loss of riverine habitat would be unavoidable impacts resulting from the installation of flashboards at Macallen Dam. Based on these findings, the dEA recommended that boards not be included in any license issued for the site.

Subsequent to the dEA, the Commission notified the applicants that their projects could not be justified as economically and financially feasible (by letter dated June 30, 1988). In response to the notification, the application for Project number 6602 was withdrawn. In view of the fact that two previous applicants invested substantial time and money in a 5-year process that proved unsuccessful, we strongly suggest that the current applicant examine the site's past history before moving forward with this proposal, which likely will face opposition at the local, regional, state and federal level.

Given the well-documented negative impacts that hydro development would have at this site, it is our recommendation that the applicant not pursue development of hydro power at this site. The Lamprey River is one of the few New England rivers with no hydro development on it. There are only three migratory barriers on the river, one of which has an effective fishway that is integral to the successful restoration of diadromous fish to the Lamprey River watershed.

Should the applicant continue to pursue the proposed project, the following should be taken into consideration during the consultation process.

1. Fish and Wildlife Resources

The Permittee will need to investigate and document the fish and wildlife resources that will be affected by the construction and operation of the project. State and federal fish and wildlife agencies should be consulted early in the planning process for their advice on impact assessment studies. After the Permittee has conducted the necessary studies, the resource agencies should again be consulted for their recommendations on measures needed to mitigate adverse impacts and compensate for unavoidable losses to fish and wildlife resources. The address for our Fish and Wildlife Service Office is 22 Bridge Street, Unit #1, Concord, New Hampshire 03301-4986.

2. Cultural Resources

The State Historic Preservation Officer (SHPO) should be consulted concerning the project to ensure compliance by the applicant and the Federal Energy Regulatory Commission (FERC) with all preservation legislation. Consideration of project effects on any existing or potential cultural resources should take place as part of the environmental evaluation during the preliminary permit period. We suggest that Article 7 in Order No. 54 Final Rule, FERC, October 22, 1979, be included in the preliminary permit. For New Hampshire, the SHPO is Nancy Dutton, Division of Historical Resources, 19 Pillsbury Street, Concord, New Hampshire 03301 (telephone 603/271-3483).

3. Recreational Resources

An assessment of the recreation potential of the project should be undertaken during the preliminary permit period in consultation with the State Liaison Officer (SLO), county officials, and local community groups and agencies concerned with providing opportunities for public recreation. The assessment should include consideration of recreation needs and priorities identified in the Statewide Comprehensive Outdoor Recreation Plan. The SLO for New Hampshire is Commissioner William S. Bartlett, Department of Resource and Economic Development, 172 Pembroke Road, P.O. Box 1856, Concord, New Hampshire 03301 (telephone 603/271-2411).

Thank you for the opportunity to comment on this application.

Sincerely yours,

Michael J. Bartlett
Supervisor
New England Field Office

CC: John R. Lavigne, Jr.
SFC Engineering Partnership, Inc.
25 Sundial Avenue, Suite 205W
Manchester, NH 03103
EPA, Ralph Abele
NHFGD, Bill Ingham
NHFGD, Doug Grout (Durham)
NPS, Jamie Fosburgh (Boston)
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ORIGINAL

michael.spencer@FER, 04:38 AM 3/8/00 -, Project number P-11823-000 in

To: michael.spencer@FERC.fed.us
From: Preston Samuel <pls3116@nh.ultranet.com>
Subject: Project number P-11823-000 in the Town of Newmarket at the Macallen Dam
Cc:
Bcc:
Attached:

I am a property owner on the Lamprey River, about a quarter mile above the MacAllen Dam in Newmarket, NH. I was recently advised that someone was considering hydro power at the dam. It has been said that the project would add flashboards with an additional elevation of between two to four feet.

The use of the dam for power has been dormant for many years. During that time, residential projects have been built on both sides of the river all the way upstream to the Newmarket Town Line. If the water level were raised, it would affect all of these homes to one degree or another.

During a reputed 100 year storm three years ago, several houses were flooded to the degree that they were evacuated. The water was dangerously close to flood a major apartment building owned by the Cheney Corporation. The water backed up in several small tributaries and flooded streets in surrounding subdivisions to the point that it was becoming dificult to get in to certain areas of town.

Obviously, the construction of flashboards would have an affect on the hundred year floodplain in the future. It would jepordize an untold number of homes directly abutting the water, and for several blocks back.

In my opinion, the filing of the application to study the hydro power proposal was premature, understudied, inconsiderate, and a waste of government time and money. I wish to go on record as strongly opposing the current proposal, although I do support low-head hydro power.

Please enter this email as a record in the appropriate public comment file.

Very truly yours,

Preston Samuel
10 Bass Street
Newmarket, NH 03857
(603) 659 - 3518

cc: Al Dixon, Town Administrator

David Boergers
Secy. Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

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