To: April Talon, PE
Town of Durham

Date: April 8, 2020

Project #: 52633.00

Memorandum

From: Peter J. Walker (VHB)
Allen Orsi, PE (Pare)

Re: Mill Pond Dam Feasibility Study
Summary of Preliminary Alternatives

EXECUTIVE SUMMARY

The project team has completed a preliminary review of alternatives to address the known structural deficiencies of the Mill Pond Dam. Five distinct alternatives have been developed:

Alternative 1 – No Action: This alternative would require that the NHDES Dam Bureau approve a "non-menace waiver," which would remove the requirement that the dam pass a 50-year spillway design flow. Hydraulic modeling completed to date suggests that NHDES may approve such a waiver request. However, as documented in Pare's recent dam inspection, the condition of the dam poses a near-term structural risk. The *No Action Alternative*, therefore, is not recommended.

Alternative 2 – Repair: This alternative would include: structural reinforcement of the spillway ribs; reinforcement of the right training wall; repairs to the fish ladder to address undermining; stabilization of the gated outlet; and replacement of the outlet gates. This alternative would require that the NHDES Dam Bureau approve a "non-menace waiver." Repair would only address areas of extensive concrete deterioration and would not address all concrete that has been impacted by alkali-silica reaction (ASR) and other deterioration; as such, the effective design life of this approach is limited. The cost of Alternative 2 is expected to fall within a range of $450,000 to $550,000, not including the measures needed to restore the pond, improve water quality, and mitigate adverse natural resource and historic impacts.[1]

Alternative 3 – Stabilization: This alternative would include: Construction of a "new" spillway within the confines of the existing spillway by pumping reinforced concrete within each of the spillway cells to create a mass concrete section that would be anchored to the bedrock; repairs to the fish ladder to address undermining; stabilization of the gated outlet; and replacement of the outlet gates. The approach would provide a long-term solution to the concerns for the existing dam. However, like Alternative 1 and 2, this alternative would require that the NHDES Dam Bureau approve a "non-menace waiver." The cost of Alternative 3 is expected to fall within a range of $300,000 to $425,000, not including the measures needed to restore the pond, improve water quality, and mitigate adverse natural resource and historic impacts.

Alternative 4 - Dam Redesign: This alternative would involve modifying the dam to pass the 50-year spillway design storm event with 1-foot of freeboard, and would therefore not require NHDES approval of a non-menace waiver. The required modifications would include: Replacing the existing spillway with a new spillway, maintaining the current crest elevation; lowering the top of the gated outlet structure approximately 2 feet to effectively widen the spillway by

[1] All costs reported in this memo are based on conceptual designs and are therefore considered preliminary and likely to change as design proceeds. They are provided to allow for a relative comparison of the initial capital costs of each alternative.

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26 feet; providing an auxiliary spillway extending into the right abutment at an elevation approximately 1.7 feet higher than the spillway crest; raise the effective top of dam elevation by 1.85 feet by constructing an approximately 50-foot long earthen berm/dike at the right abutment and grading left of the fish ladder to meet design top of dam elevations; and reconstruction of the existing spillway to address structural concerns. This alternative would also include replacing the gated outlet structure and addressing other known concerns including undermining of the fish ladder. Alternative 4 would have an anticipated design life exceeding 50 years. The cost of Alternative 4 is expected to fall within a range of $600,000 to $800,000, not including the measures needed to restore the pond, improve water quality, and mitigate adverse natural resource and historic impacts.

Alternative 5 - Dam Removal: Dam removal would involve: demolition of the spillway structure and the fish ladder, while preserving the gated outlet at the right abutment and the fish ladder forebay/left abutment concrete wall to help ensure bank stabilization and minimize historical impact. A reconstructed river channel and floodplain would be created through the former location of the dam, designed to simulate the geomorphology of a natural river with a channel slope consistent with the Oyster River. Based on similar dam removal projects, the cost of dam removal could be expected to range from $300,000 to $750,000, depending on the specific requirements to mitigate sediment migration or contamination concerns in the impoundment. The cost of this alternative may be offset by state and federal grant programs intended to restore aquatic habitats.

INTRODUCTION

The project team has completed a preliminary review of alternatives to address the known structural deficiencies of the Mill Pond Dam. Our review considers the 2018 Letter of Deficiency issued by the NH Department of Environmental Services (NHDES) Dam Bureau to the Town of Durham,[2] but also incorporates new data and modeling generated during this phase of the Feasibility Study. This new information includes a recently completed dam inspection,[3] as well as refined hydrological and hydraulic modeling.

Perhaps most importantly, the hydraulic modeling completed to date suggests that a waiver request to NHDES to treat the dam as Non-menace while maintaining a Low hazard classification may be viable.[4] This is important, because, if a waiver request is approved by NHDES, then viable alternatives would need only to preserve the existing spillway capacity, rather than increase the capacity to the design criteria for a Low-hazard dam (i.e., pass the 50-year storm with 1 foot of freeboard). As such, the scope of the preliminary alternatives was narrowed to consider approaches assuming that the waiver is issued. Therefore, the list of alternatives discussed below includes options which would

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2 NHDES Letter of Deficiency, DSP #18-010, dated February 12, 2018.

3 Pare Corporation. 2020. Technical Report entitled, “Mill Pond Dam, Visual Inspection Report, Durham, New Hampshire, Dam ID D71.03” issued February 2020.

4 See Steve N. Doyon’s letter to April Talon dated September 20, 2018, for a discussion of the dam hazard classification.

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preserve the current spillway capacity (Alternative 1, 2, and 3), as well modify the site such that discharge capacity requirements are met (Alternatives 4 and 5). It should be noted that while issuance of a waiver from a regulatory standpoint appears possible, such approval is subject to NHDES review and approval and is anticipated to be contingent on conditions such as the execution of legal agreements between the dam owner and abutter(s).

BACKGROUND

Based upon past documentation pertaining to the dam and the December 2019 dam inspection, multiple deficiencies have been noted at the dam, including the following:

- Concrete deterioration of the spillway cell ribs
- Concrete deterioration and seepage at the gated outlet structure
- Inoperable and partially inoperable gates
- Scour at the right training wall and at the base of the fish ladder between Cell 9 and the fish ladder outlet

The concrete structures at the Mill Pond Dam show various degrees of advanced deterioration. This deterioration poses both short- and long-term concerns for the structural stability of the dam. As such, measures are warranted to address the identified deficiencies.

In addition to identified concerns at the dam, sedimentation, shallow water, and poor water quality have been identified as concerns within the impoundment, affecting both the recreational opportunities and aesthetic benefit provided by the dam.

SUMMARY OF PRELIMINARY ALTERNATIVES

As part of the alternatives screening scope of work, five distinct alternatives have been considered including 1) No Action, 2) Repair, 3) Stabilization, 4) Redesign, and 5) Removal. Each of these alternatives are presented in detail in the sections below and in the attached conceptual design sketches.

Alternative 1 – No Action

Under the No-Action Alternative, no work would be completed at the dam to address the identified regulatory or physical deficiencies, except for ongoing operations, maintenance, and inspections. If the non-menace waiver is approved, then the No Action Alternative would meet NHDES requirements for a Non-menace dam. However, as previously documented, the condition of the concrete ribs supporting the spillway poses a short-term structural issue given the continued and progressive loss of concrete functioning to support the spillway slab. Furthermore, the No-Action Alternative would not address the current issues with poor water quality, aquatic habitat, or recreational

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resources. As such, No Action would serve to jeopardize the structural condition of the dam, potentially resulting in a sudden failure of a portion of the spillway and loss of the impoundment. *Therefore, the No-Action Alternative is not considered an appropriate alternative and is not recommended.*

Alternative 2 - Repair

Alternative 2 - Repair would implement improvements at the dam to address the immediately identified structural concerns. Conceptually, as shown on Figure 2, this alternative would include the following activities:

a. Spillway Ribs: Structurally reinforce the spillway ribs. Ribs may be reinforced through a variety of structural improvement measures including jacketing the ribs within a reinforced concrete shell, temporary spillway bracing and reconstruction of the deteriorated rib sections, and/or isolated concrete patch repairs. Extent and type of repair would be determined through subsequent evaluation and design.

b. Right Training Wall Scour: Remove deteriorated concrete in the area of scour; Replace with new reinforced concrete.

c. Fish Ladder Undermining: Fill the void beneath the fish ladder with flowable fill or other suitable fill material; provide a scour apron to prevent recurrence.

d. Gated Outlet Stabilization: Construct a new gravity section upstream of the existing gated outlet structure to provide an overall section meeting stability requirements. Complete concrete repair throughout the structure including removal of deteriorated concrete and replacement with new reinforced concrete.

e. Gate Replacement: Remove and dispose the existing gates; install new gates. Through recent operations, the left gate has sufficient capacity to drain the impoundment; as such, the right gate could be removed and the conduit through the gated outlet structure could be properly abandoned/filled.

This alternative is anticipated to address the immediate structural concerns noted along the dam. However, the scope of work is limited to addressing areas of significant concrete deterioration currently present at the dam. The scope of work does not include complete replacement of concrete components which have been shown through past studies to have been impacted by alkali-silica reaction (ASR) and other deterioration indicative of the age and poor condition of the concrete. As such, the effective design life of this approach may be limited.

The cost of Alternative 2 is expected to fall within a range of $450,000 to $550,000, not including the measures needed to restore the pond, improve water quality, and mitigate adverse natural resource and historic impacts.

Alternative 3 - Stabilization

Alternative 3 - Stabilization would provide a means by which to improve the long-term stability of the dam. For the purpose of alternatives screening, stabilization was considered to mean implementing measures that would limit

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changes to the existing structure while providing a structure designed for long term stability. Conceptually, as shown on Figure 3, Alternative 3 would include:

a. Spillway Stabilization: Essentially design and construct a "new" spillway within the confines of the existing spillway. This could be achieved through the installation of reinforced concrete within each of the spillway cells and around the rib walls to create a mass concrete section. Concrete reinforcement and anchors to the bedrock foundation would be provided, resulting in a spillway section that would be stable regardless of the presence of the existing spillway structure.

b. Gated Outlet Structure: Stabilization would include addressing stability and structural concerns at the gated outlet structure. In general, this work would take a form similar in nature and extent to the Repair alternative (See Items 2.d and 2.e above).

This alternative would also include the completion of additional repair work as discussed above including addressing scour of the existing right training wall and undermining of the fish ladder downstream of the spillway. The approach of designing and installing independent structures is anticipated to provide a long-term solution to the concerns for the existing dam.

The cost of Alternative 3 is expected to fall within a range of $300,000 to $425,000, not including the measures needed to restore the pond, improve water quality, and mitigate adverse natural resource and historic impacts.

Alternative 4 - Dam Redesign

Alternative 4 – Dam Redesign includes designing and implementing modifications to the dam to address known structural concerns, potential structure/long term stability concerns, and address all regulatory deficiencies. Alternative 4 would comply with applicable regulations for Low Hazard dams; receipt of a waiver to treat the dam as Non-menace would not be required to implement this alternative.

As conceptually shown on Figure 4, the alternative includes:

a. Modifying the dam to provide sufficient capacity to accommodate the 50-year spillway design storm event with 1-foot of freeboard. Based upon hydrologic and hydraulic modeling completed by Weston & Sampson, the required modifications could include:

    1. Raising the design top of the dam approximately 1.85 feet while maintaining the current spillway crest elevation; modifications associated with raising the top of the dam would primarily include increasing the right abutment area and top of the fish ladder / left abutment such that they do not overtop during the spillway design flood event.

    2. Lowering the top of the gated outlet structure approximately 2 feet to effectively widen the spillway by 26 feet.

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3. Providing an auxiliary spillway extending into the right abutment at an elevation approximately 1.7 feet higher than the spillway crest.
4. Constructing an approximately 50-foot long earthen berm/dike to tie the new system into the design top of dam elevation at the right abutment.
5. Grading left of the fish ladder to meet design top of dam elevations.

b. Reconstruction of the existing spillway to address structural concerns.

c. Replacement of the gated outlet structure to address structural and stability concerns; providing a new low level outlet.

d. Addressing other known concerns including undermining of the fish ladder at the left end of the spillway.

A number of variations of the spillway geometry modifications could be considered as part of final design to select the most beneficial layout.

Alternative 4 would provide a new dam which would meet applicable NHDES design requirements with an anticipated design life exceeding 50 years. During final design, considerations could be incorporated into the proposed structure to maintain the aesthetic character of the existing dam while providing a dam meeting current design standards.

The cost of Alternative 4 is expected to fall within a range of $600,000 to $800,000, not including the measures needed to restore the pond, improve water quality, and mitigate adverse natural resource and historic impacts.

Alternative 5 - Dam Removal

Alternative 5 would remove the dam from the river. Conceptually, as shown on Figure 5, dam removal would include:

a. Complete demolition and removal of the spillway structure and the fish ladder.

b. Preservation of the gated outlet at the right abutment and the fish ladder forebay/left abutment concrete wall to protect the long-term stability of the abutments during high flow storm events and to mitigate historic impacts.

c. Creation of a reconstructed river channel through the former location of the dam, designed to simulate the geomorphology of a natural river with a channel slope consistent with the macro-scale longitudinal profile of the Oyster River in the vicinity of Mill Pond. The channel would have a roughly 42-foot bankfull width, incorporating a 12-foot wide low-flow channel at the thalweg, to provide fish passage under low flow conditions.

d. Areas beyond the limits of the channel would be restored to provide floodplain and habitat in the vicinity of the former dam.

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Pending results of ongoing sediment quantification and characterization, additional mitigation may be required further upstream of the dam and within the former impoundment area to address any identified sediment migration or contamination concerns.

Based on similar dam removal projects, the cost of dam removal could be expected to range from $300,000 to $750,000, depending on the specific requirements to mitigate sediment migration or contamination concerns in the impoundment. The cost of this alternative may be offset by state and federal grant programs intended to restore aquatic habitats.

Attachments:
Figure 1: Existing Conditions / No Action
Figure 2: Conceptual Dam Repair Sketch
Figure 3: Conceptual Dam Stabilization Sketch
Figure 4: Conceptual Dam Redesign Sketch
Figure 5: Conceptual Dam Removal Sketch
Opinions of Probable Cost

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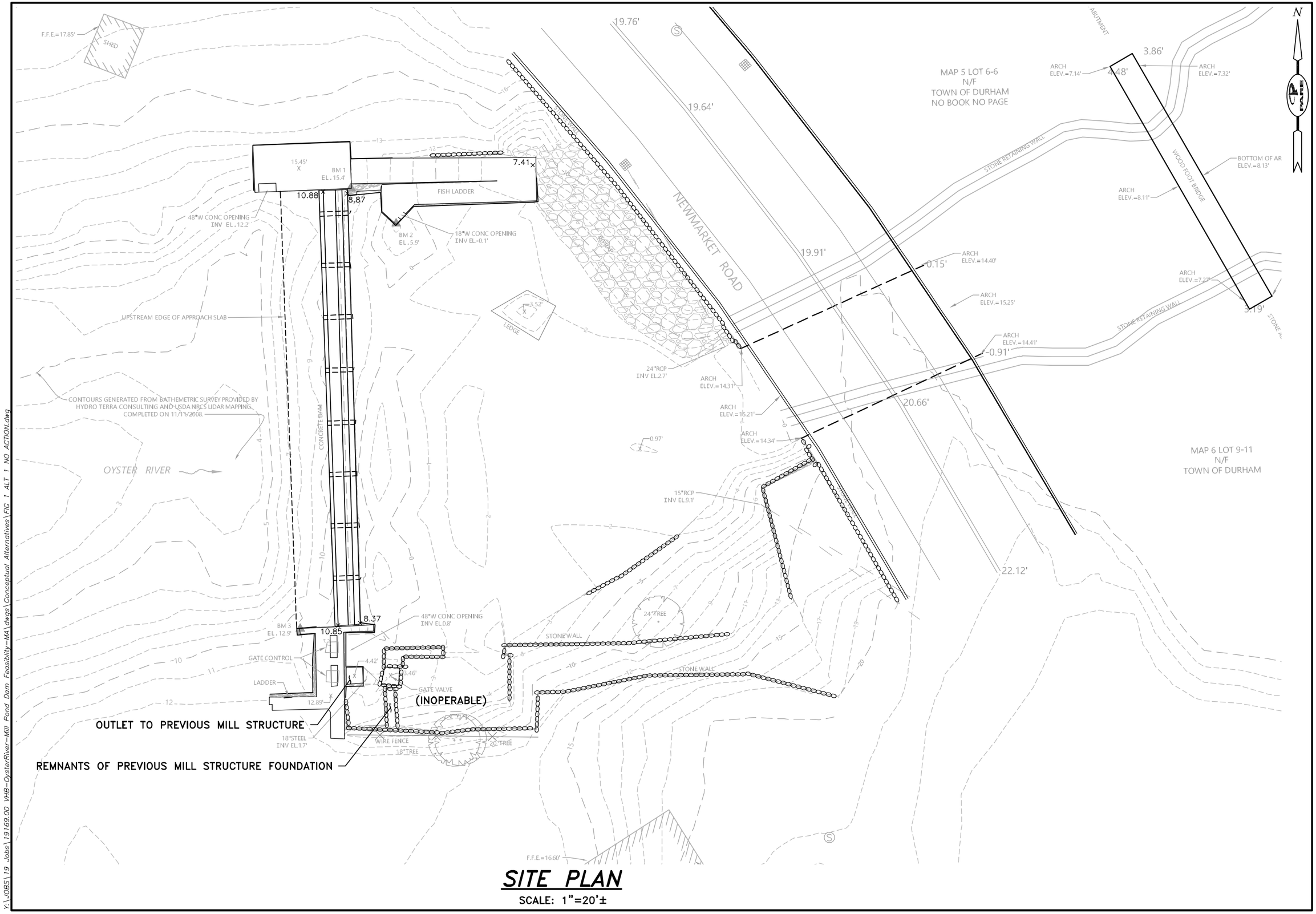

SITE PLAN

SCALE: 1"=20'±

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MILL POND DAM

D71.03

DURHAM, NEW HAMPSHIRE

OWNER: TOWN OF DURHAM

THE TOWN OF DURHAM N.H. SEAL OF THE 1732

SCALE ADJUSTMENT GUIDE

0" 1"

BAR IS ONE INCH ON ORIGINAL DRAWING.

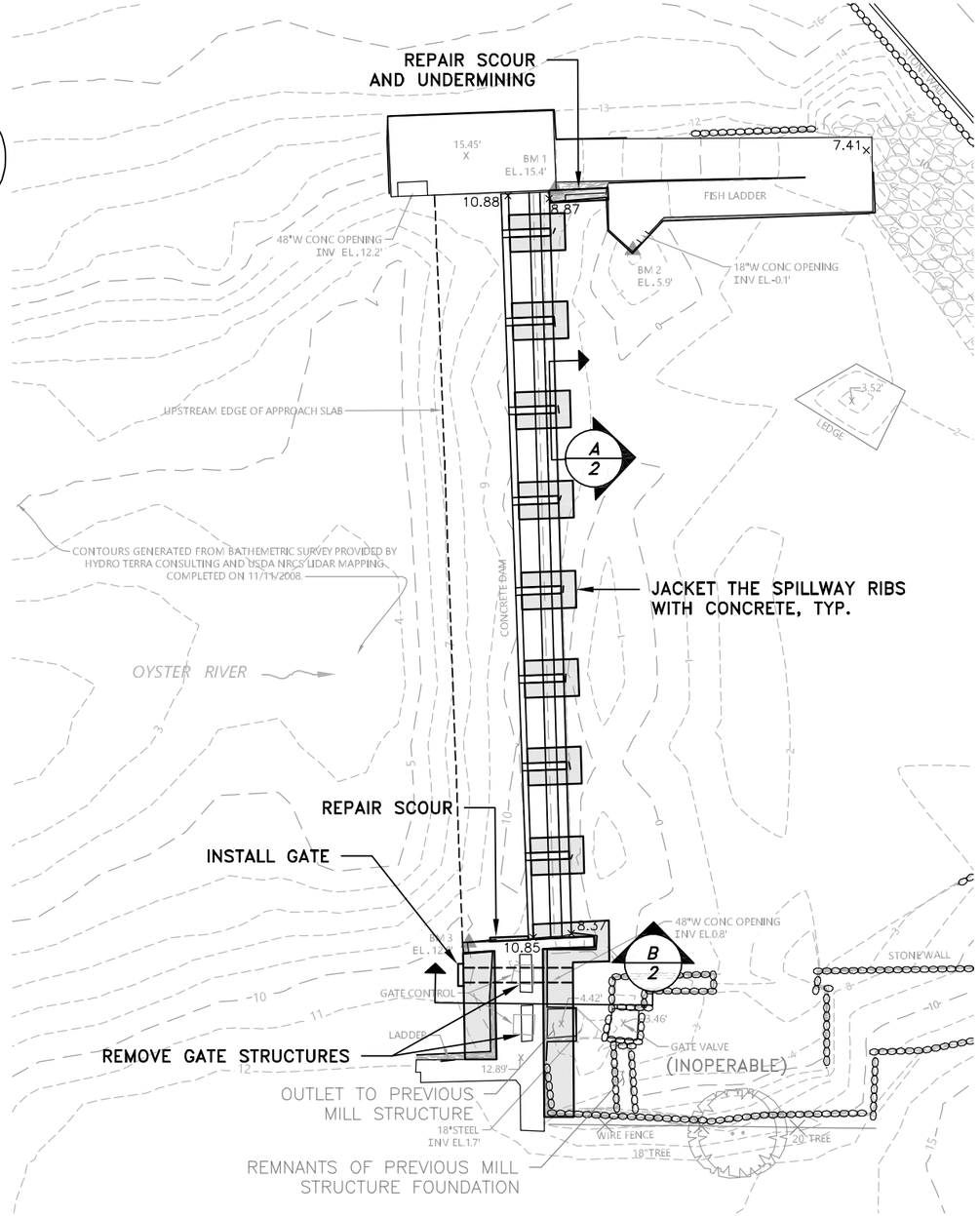
REVISIONS:		

PROJECT NO.:	19169.00
DATE:	MARCH 2020
SCALE:	AS NOTED
DESIGNED BY:	HMS
CHECKED BY:	ARO
DRAWN BY:	LMC
APPROVED BY:	ARO

EXISTING CONDITIONS NO ACTION

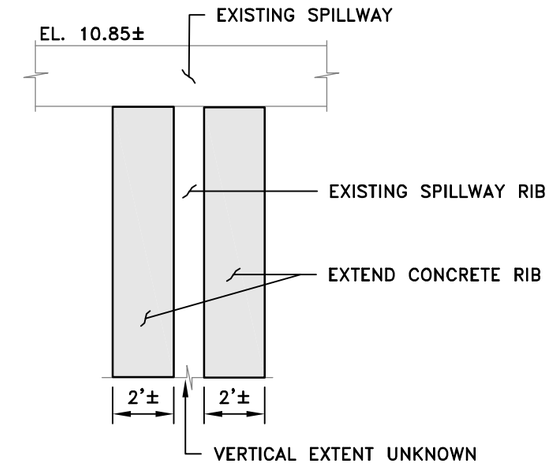
FIGURE NO.: 1

Y:\JOBS\19 Jobs\19169.00 VHB-OysterRiver-Mill Pond Dam Feasibility-MA\dwgs\Conceptual Alternatives\FIG 1 ALT 1 NO ACTION.dwg



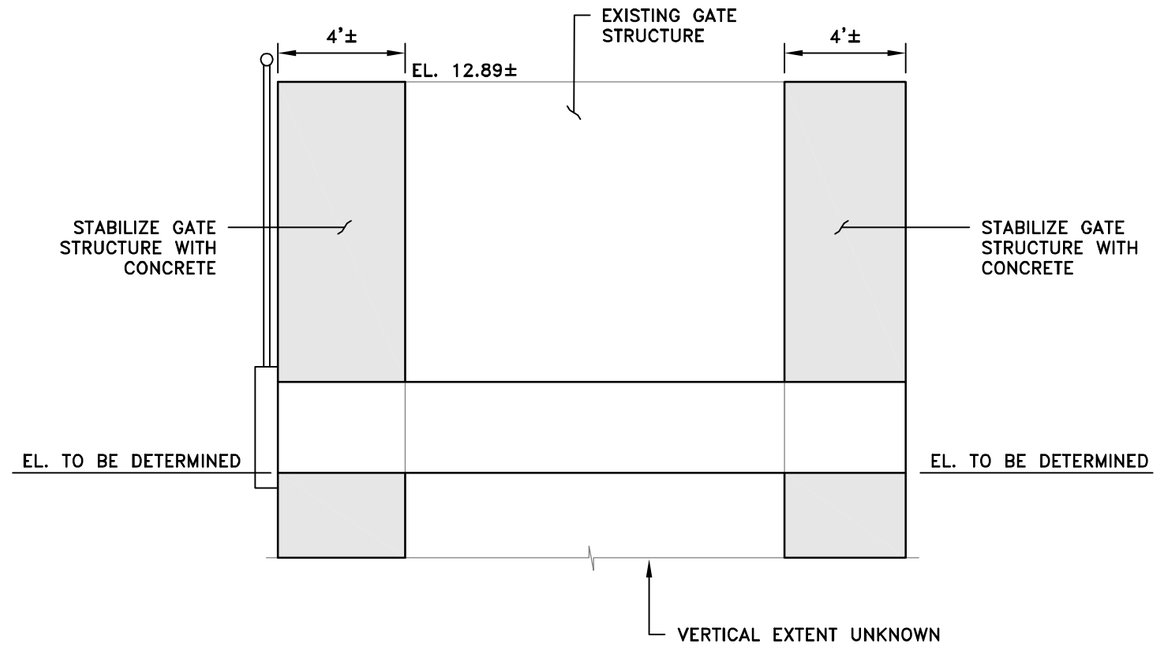
SITE SKETCH

SCALE: 1"=20'±



A/2 SECTION A

SCALE: 1"=5'



B/2 SECTION B

SCALE: 1"=5'

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OWNER: TOWN OF DURHAM

TOWN OF DURHAM N.H. SEAL OF THE 1732

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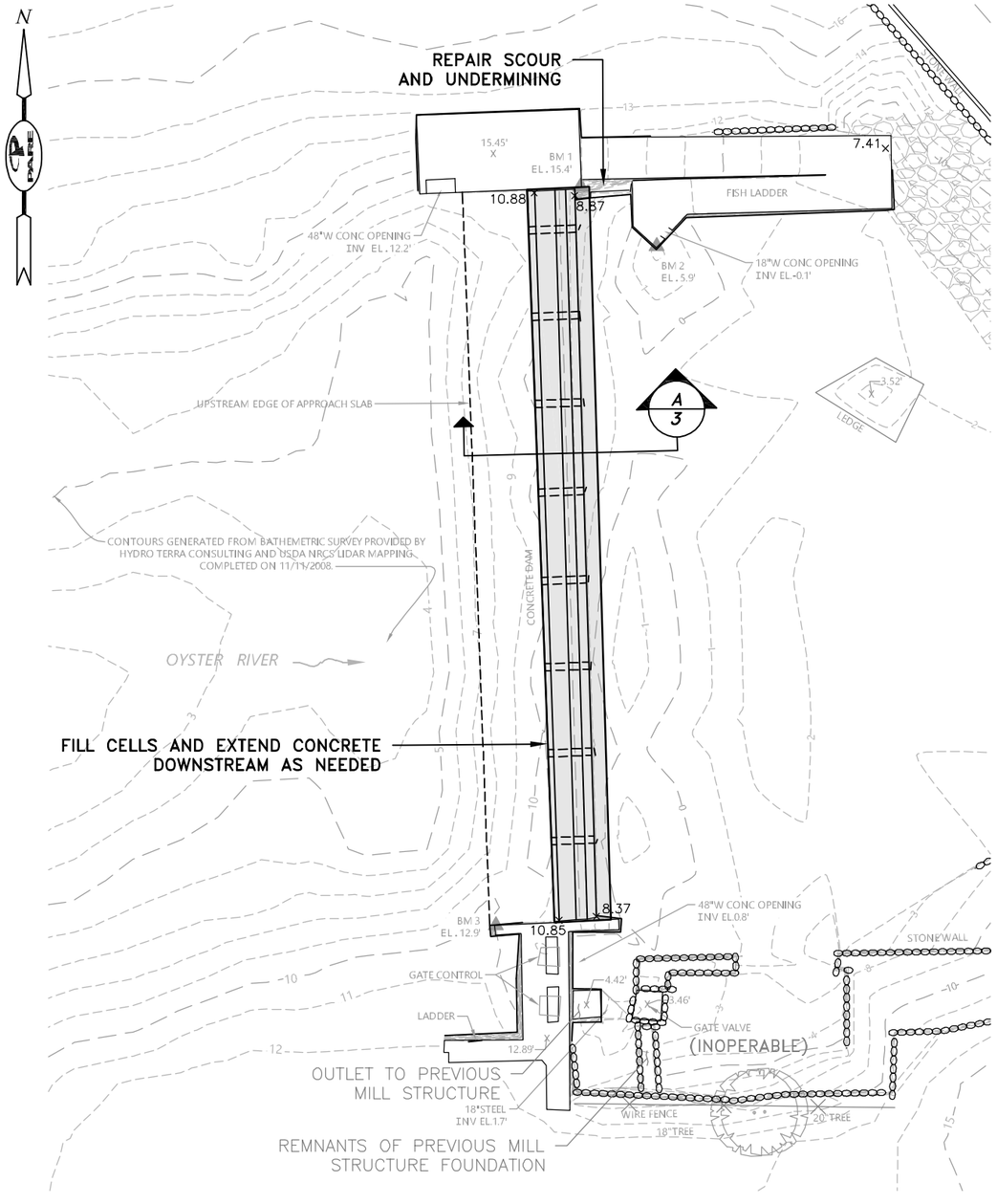
DESIGNED BY:	HMS
CHECKED BY:	ARO
DRAWN BY:	LMC
APPROVED BY:	ARO

CONCEPTUAL DAM REPAIR SKETCH

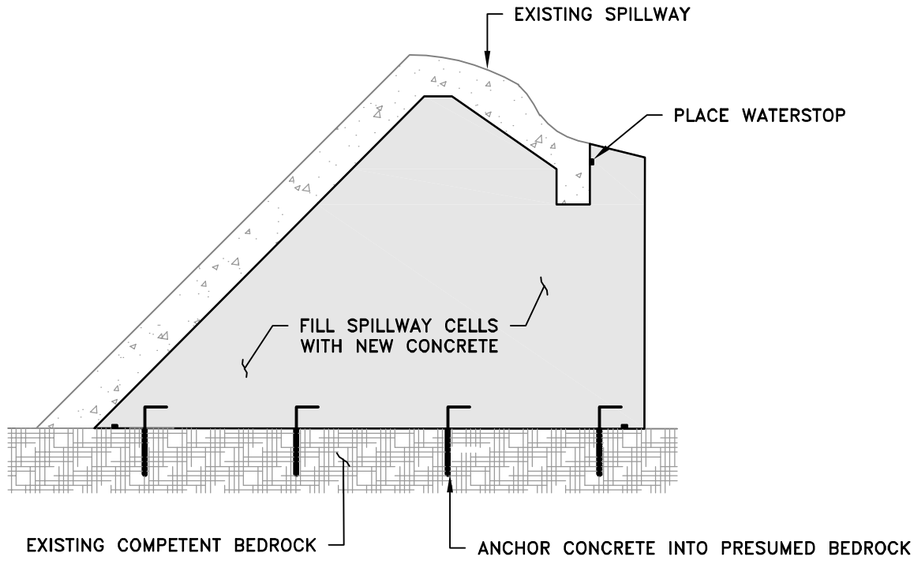
FIGURE NO.: 2

Y:\JOBS\19 Jobs\19169.00 VHB-OysterRiver-Mill Pond Dam Feasibility-MA\dwgs\Conceptual Alternatives\FIG 2 ALT 2 REPAIR.dwg



SITE SKETCH

SCALE: 1"=20'±



A/3 SECTION A

SCALE: 1"=2'

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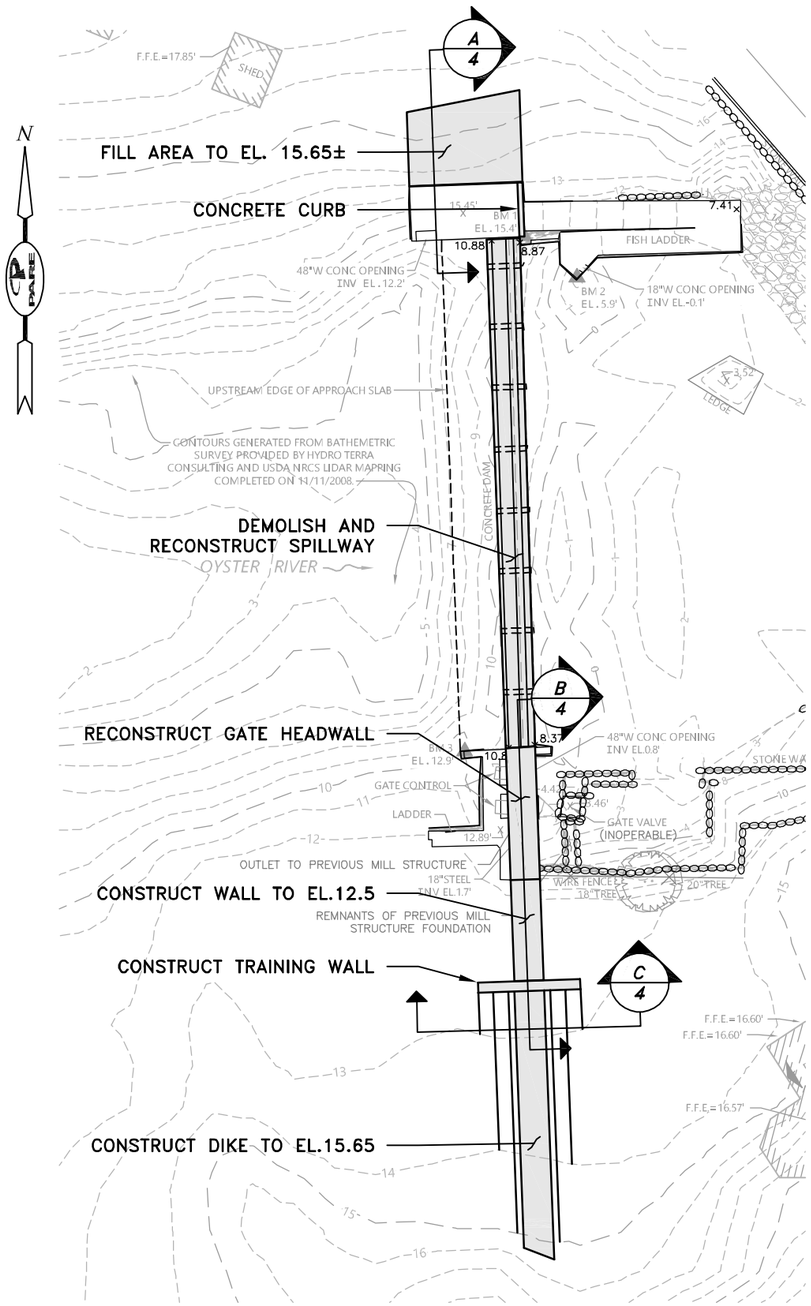
CONCEPTUAL DAM STABILIZATION SKETCH

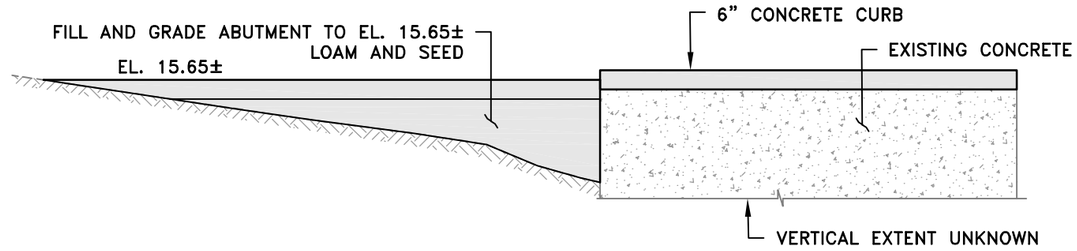
FIGURE NO.: 3

Y:\JOBS\19 Jobs\19169.00 VHB-OysterRiver-Mill Pond Dam Feasibility-MA\dwgs\Conceptual Alternatives\FIG 3 ALT 3 STABILIZE.dwg



SITE SKETCH

SCALE: 1"=30'±



A/4 SECTION A

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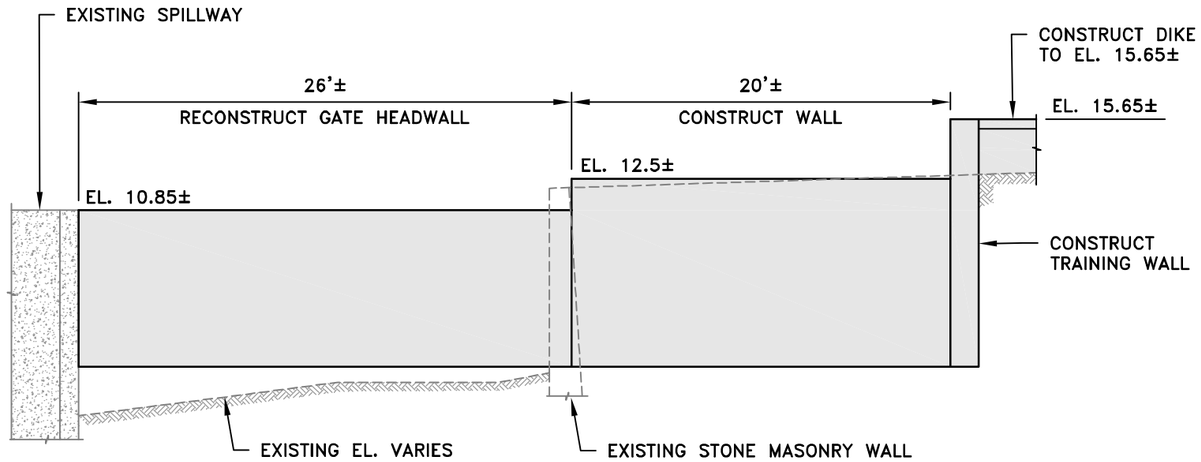

B/4 SECTION B

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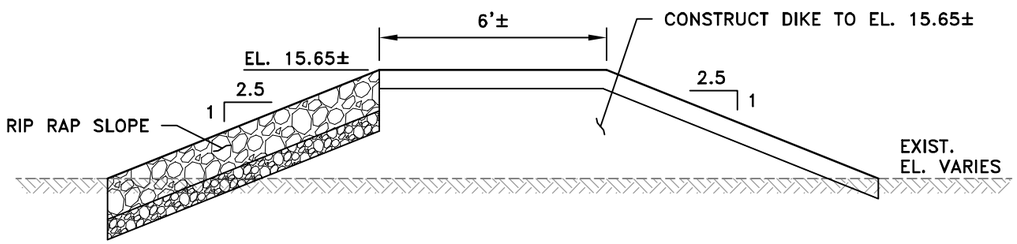

C/4 SECTION C

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OWNER: TOWN OF DURHAM

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CONCEPTUAL DAM REDESIGN SKETCH

FIGURE NO.: 4

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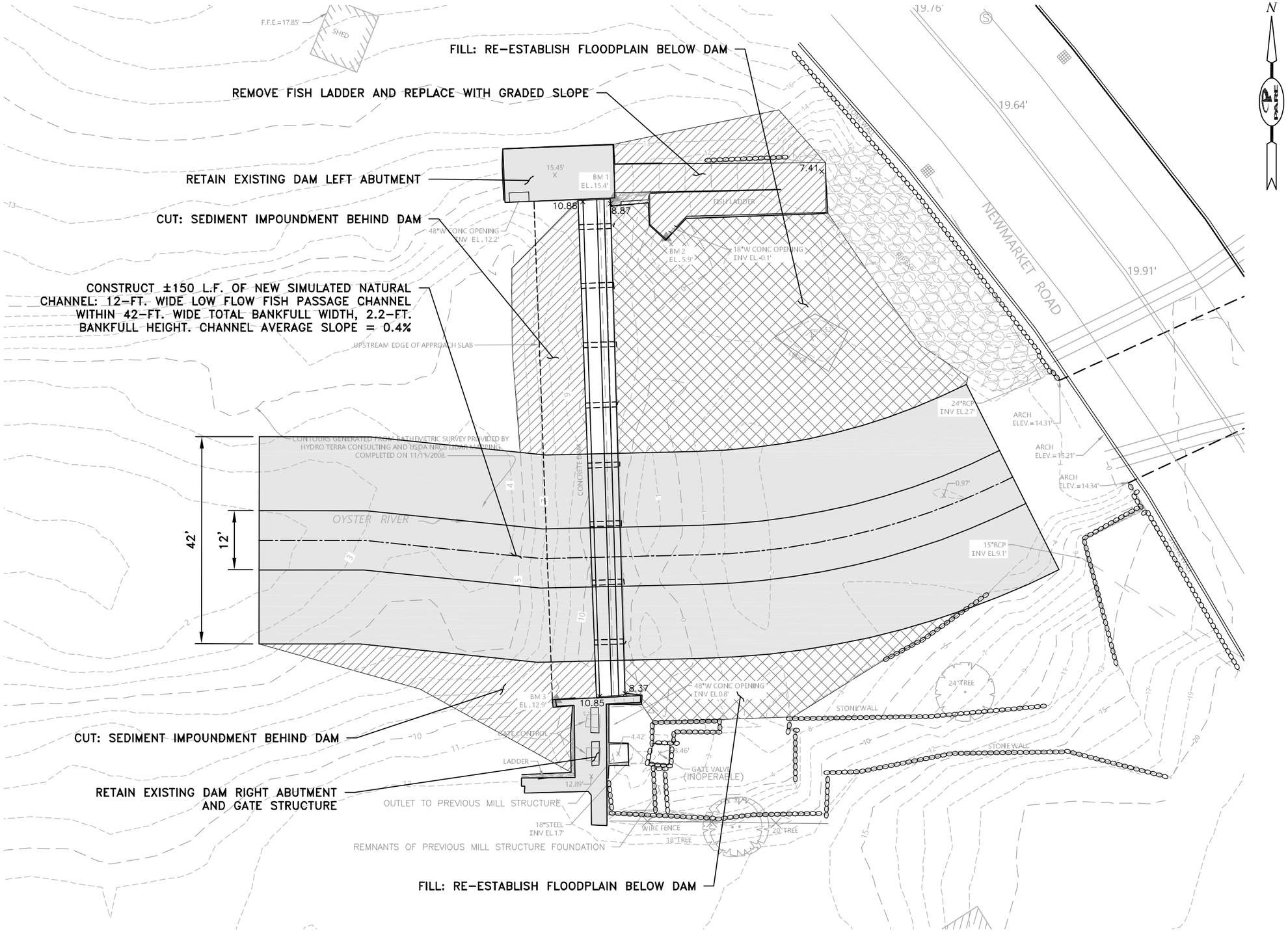

SITE SKETCH

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CHECKED BY:	ARO
DRAWN BY:	LMC
APPROVED BY:	ARO

CONCEPTUAL DAM REMOVAL SKETCH

FIGURE NO.:

5

Y:\JOBS\19 Jobs\19169.00 VHB-OysterRiver-Mill Pond Dam Feasibility-MA\dwgs\Conceptual Alternatives\FIG 5 ALT 5 REMOVAL.dwg

PARE CORPORATION

PROJECT : Old Mill Pond Dam - Durham, NH | PROJECT NUMBER: 19169.00
SUBJECT: Conceptual Opinion of Probable Cost - Spillway Stabilization
COMPUTATIONS BY: HMS | DATE: MAR 2020
CHECK BY: | DATE:

CONCEPTUAL OPINION OF PROBABLE COST - Repairs

Item	Quantity	Unit	Unit Price	Total	Source
General Bid Items					
Portable Toilets	2	MON	$ 150.00	$ 300.00	Engineers Judgment
Project Superintendent	2	MON	$ 8,200.00	$ 16,400.00	Engineers Judgment
QC Plans	1	LS	$ 1,000.00	$ 1,000.00	Engineers Judgment
Submittals	5	EA	$ 175.00	$ 875.00	Engineers Judgment
Schedules	1	EA	$ 150.00	$ 150.00	Engineers Judgment
Meetings	2	EA	$ 150.00	$ 300.00	Engineers Judgment
Concrete Sampling/Testing	6	EA	$ 400.00	$ 2,400.00	Engineers Judgment
Concrete Compression Tests	6	EA	$ 30.00	$ 180.00	Engineers Judgment
Subtotal				**$ 21,605.00**	
Mobilization & Demolition					
Mobilization	1	LS	$ 10,000.00	$ 10,000.00	Engineers Judgment
Demobilization	1	LS	$ 7,500.00	$ 7,500.00	Engineers Judgment
Subtotal				**$ 17,500.00**	
Erosion & Sediment Control					
Turbidity Barriers	0	LF	$ 30.00	$ -	NH645.0001
Maintenance	0	LS	$ 1,000.00	$ -	Engineer's Judgement
Subtotal				**$ -**	
Control of Water					
Engineering Design	1	LS	$ 10,000.00	$ 10,000.00	Recent Project Costs
Cofferdam / Diversions	1	LS	$ 35,000.00	$ 35,000.00	Recent Project Costs
Subtotal				**$ 45,000.00**	
Stabilize spillway ribs					
Form/Place Concrete	80	CY	$ 1,400.00	$ 112,000.00	Recent Project Costs/Engineer's Judgement
Subtotal				**$ 112,000.00**	
Repair Gated Outlet					
Remove&Dispose Exisitng Gates	1	LS	$ 2,000.00	$ 2,000.00	Recent Project Costs
New Slide Gate	1	LS	$ 10,000.00	$ 10,000.00	Recent Project Costs
Install Slide Gate	2	DAY	$ 2,500.00	$ 5,000.00	Recent Project Costs
Stabilize Upstream side with concrete	25	CY	$ 1,250.00	$ 31,250.00	Recent Project Costs
Stabilize downstream side with concrete	35	CY	$ 1,250.00	$ 43,750.00	Recent Project Costs
Subtotal				**$ 92,000.00**	
scour repair					
Fill scour at Fish ladder	6	CF	$ 250.00	$ 1,500.00	Recent Project Costs
Fill scour at right training wall	4	CF	$ 250.00	$ 1,000.00	Recent Project Costs
Subtotal				**$ 2,500.00**	
			SUBTOTAL	**$ 291,000.00**	(Rounded to the nearest $1,000)
			Contract Bonds	$ 3,000.00	1% of Project Subtotal
			Contingency	$ 88,000.00	30%
			OPINION OF TOTAL CONSTRUCTION COST (Base Work)	**$ 382,000.00**	
			Engineering, Design, and Permitting	$ 90,000.00	
			Construction Phase Services Budget	$ 60,000.00	
			OPINION OF TOTAL CONSTRUCTION PHASE COST (Base Work)	**$ 532,000.00**	

PARE CORPORATION

PROJECT : Old Mill Pond Dam - Durham, NH PROJECT NUMBER: 19169.00

SUBJECT: Conceptual Opinion of Probable Cost - Spillway Stabilization

COMPUTATIONS BY: HMS DATE: MAR 2020

CHECK BY: DATE:

CONCEPTUAL OPINION OF PROBABLE COST - Stabilization

Item	Quantity	Unit	Unit Price	Total	Source
General Bid Items					
Portable Toilets	2	MON	$ 150.00	$ 300.00	Engineers Judgment
Project Superintendent	2	MON	$ 8,200.00	$ 16,400.00	Engineers Judgment
QC Plans	1	LS	$ 1,000.00	$ 1,000.00	Engineers Judgment
Submittals	5	EA	$ 175.00	$ 875.00	Engineers Judgment
Schedules	1	EA	$ 150.00	$ 150.00	Engineers Judgment
Meetings	4	EA	$ 150.00	$ 600.00	Engineers Judgment
Concrete Sampling/Testing	8	EA	$ 400.00	$ 3,200.00	Engineers Judgment
Concrete Compression Tests	32	EA	$ 30.00	$ 960.00	Engineers Judgment
Subtotal				**$ 23,485.00**	
Mobilization & Demolition					
Mobilization	1	LS	$ 10,000.00	$ 10,000.00	Engineers Judgment
Demobilization	1	LS	$ 5,000.00	$ 5,000.00	Engineers Judgment
Subtotal				**$ 15,000.00**	
Erosion & Sediment Control					
Turbidity Barriers	105	LF	$ 30.00	$ 3,150.00	NH645.0001
Maintenance	1	LS	$ 1,000.00	$ 1,000.00	Engineer's Judgement
Subtotal				**$ 3,150.00**	
Control of Water					
Engineering Design	1	LS	$ 7,500.00	$ 7,500.00	Recent Project Costs
Cofferdam / Control of Water	1	LS	$ 20,000.00	$ 20,000.00	Recent Project Costs
Subtotal				**$ 27,500.00**	
Spillway Stabilization					
Form/Place Concrete Within Spillway Cells	130	CY	$ 1,400.00	$ 182,000.00	Recent Project Costs/Engineer's Judgement
Subtotal				**$ 182,000.00**	
			SUBTOTAL	**$ 252,000.00**	(Rounded to the nearest $1,000)
			Contract Bonds	$ 3,000.00	1% of Project Subtotal
			Contingency	$ 77,000.00	30%
			OPINION OF TOTAL CONSTRUCTION COST (Base Work)	**$ 332,000.00**	
			Engineering, Design, & Permitting	$ 90,000.00	
			Construction Phase Services Budget	$ 60,000.00	
			OPINION OF TOTAL CONSTRUCTION PHASE COST (Base Work)	**$ 392,000.00**	

PARE CORPORATION

PROJECT : Old Mill Pond Dam - Durham, NH	PROJECT NUMBER: 19169.00
SUBJECT: Conceptual Opinion of Probable Cost - Redesign	
COMPUTATIONS BY: HMS	DATE: MAR 2020
CHECK BY:	DATE:

CONCEPTUAL OPINION OF PROBABLE COST - Redesign

Item	Quantity	Unit	Unit Price	Total	Source
General Bid Items					
Portable Toilets	4	MON	$ 150.00	$ 600.00	Engineers Judgment
Project Superintendent	4	MON	$ 8,200.00	$ 32,800.00	Engineers Judgment
QC Plans	1	LS	$ 1,000.00	$ 1,000.00	Engineers Judgment
Submittals	15	EA	$ 175.00	$ 2,625.00	Engineers Judgment
Schedules	8	EA	$ 150.00	$ 1,200.00	Engineers Judgment
Meetings	16	EA	$ 150.00	$ 2,400.00	Engineers Judgment
Concrete Sampling/Testing	12	EA	$ 400.00	$ 4,800.00	Engineers Judgment
Concrete Compression Tests	48	EA	$ 30.00	$ 1,440.00	Engineers Judgment
Subtotal				**$ 46,865.00**	
Mobilization & Demolition					
Mobilization	1	LS	$ 15,000.00	$ 15,000.00	Engineers Judgment
Demobilization	1	LS	$ 10,000.00	$ 10,000.00	Engineers Judgment
Subtotal				**$ 25,000.00**	
Erosion & Sediment Control					
Straw bales	100	LF	$ 7.00	$ 700.00	Recent Project Costs
Silt Fence	100	LF	$ 5.00	$ 500.00	Recent Project Costs
Maintenance	1	LS	$ 1,500.00	$ 1,500.00	Engineer's Judgment
Subtotal				**$ 2,700.00**	
Control of Water					
Engineering Design	1	LS	$ 10,000.00	$ 10,000.00	Recent Project Costs
Cofferdam / Diversions	1	LS	$ 35,000.00	$ 35,000.00	Recent Project Costs
Subtotal				**$ 45,000.00**	
Gated Outlet Headwall Demolition					
Remove&Dispose Exisitng Gates	1	LS	$ 2,000.00	$ 2,000.00	Recent Project Costs
Remove Exisiting Material	124	CY	$ 40.00	$ 4,960.00	Recent Project Costs
Disposal	230	TON	$ 15.00	$ 3,450.00	
Subtotal				**$ 10,410.00**	
Reconstruct Gated Outlet					
New Slide Gate	1	LS	$ 10,000.00	$ 10,000.00	Recent Project Costs
Install Slide Gate	2	DAY	$ 2,500.00	$ 5,000.00	Recent Project Costs
Gatehouse Concrete Structure	55	CY	$ 1,400.00	$ 77,000.00	
Subtotal				**$ 92,000.00**	
Fill Left Abutment					
Import Engineered Fill	60	TON	$ 25.00	$ 1,500.00	
Engineered Fil Placement	30	CY	$ 30.00	$ 900.00	
Import Loam	10	TON	$ 25.00	$ 250.00	
Loam and Seed	20	CY	$ 9.00	$ 180.00	
Subtotal				**$ 2,830.00**	

PARE CORPORATION

PROJECT : Old Mill Pond Dam - Durham, NH	PROJECT NUMBER: 19169.00
SUBJECT: Conceptual Opinion of Probable Cost - Redesign	
COMPUTATIONS BY: HMS	DATE: MAR 2020
CHECK BY:	DATE:

CONCEPTUAL OPINION OF PROBABLE COST - Redesign

Item	Quantity	Unit	Unit Price	Total	Source
Primary Spillway Wall					
R&D Existing	120	CY	$ 350.00	$ 42,000.00	
New Spillway	90	CY	$ 1,250.00	$ 112,500.00	
Subtotal				**$ 154,500.00**	
Auxiliary Spillway Wall					
Spillway Wall	50	CY	$ 1,400.00	$ 70,000.00	
Engineered Fil Placement	60	CY	$ 30.00	$ 1,800.00	
Training Wall	25	CY	$ 1,400.00	$ 35,000.00	
Import Engineered Fill	120	TON	$ 35.00	$ 4,200.00	
Subtotal				**$ 106,800.00**	
Construct Dike					
Import Engineered Fill	100	TON	$ 25.00	$ 2,500.00	
Engineered Fil Placement	50	CY	$ 30.00	$ 1,500.00	
Import Loam	30	TON	$ 25.00	$ 750.00	
Loam and Seed	15	CY	$ 9.00	$ 135.00	
Import Bedding Stone	30	TON	$ 35.00	$ 1,050.00	
Import Riprap	30	TON	$ 35.00	$ 1,050.00	
Riprap Slope Protection	15	SY	$ 75.00	$ 1,125.00	
Subtotal				**$ 8,110.00**	
			SUBTOTAL	**$ 495,000.00**	(Rounded to the nearest $1,000)
			Contract Bonds	$ 5,000.00	1% of Project Subtotal
			Contingency	$ 150,000.00	30%
			OPINION OF TOTAL CONSTRUCTION COST (Base Work)	**$ 650,000.00**	
			Engineering, Design, & Permitting	$ 175,000.00	
			Construction Phase Services Budget	$ 90,000.00	
			OPINION OF TOTAL CONSTRUCTION PHASE COST (Base Work)	**$ 740,000.00**	

PARE CORPORATION

PROJECT : Old Mill Pond Dam - Durham, NH | PROJECT NUMBER: 19169.00
SUBJECT: Conceptual Opinion of Probable Cost - Spillway Stabilization
COMPUTATIONS BY: HMS | DATE: MAR 2020
CHECK BY: | DATE:

CONCEPTUAL OPINION OF PROBABLE COST - Removal

Item	Quantity	Unit	Unit Price	Total	Source
General Bid Items					
Portable Toilets	2	MON	$ 150.00	$ 300.00	Engineers Judgment
Project Superintendent	2	MON	$ 8,200.00	$ 16,400.00	Engineers Judgment
QC Plans	1	LS	$ 1,000.00	$ 1,000.00	Engineers Judgment
Submittals	10	EA	$ 150.00	$ 1,500.00	Engineers Judgment
Schedules	8	EA	$ 150.00	$ 1,200.00	Engineers Judgment
Meetings	8	EA	$ 150.00	$ 1,200.00	Engineers Judgment
Proctor Tests	0	TEST	$ 225.00	$ -	Laboratory Quote plus markup
Sieve Analyses	2	TEST	$ 100.00	$ 200.00	Laboratory Quote plus markup
Field Density Testing	0	DAY	$ 500.00	$ -	Recent project bids
Chemical Soil Tests	2	TEST	$ 1,000.00	$ 2,000.00	Recent project bids
Subtotal				**$ 21,600.00**	
Mobilization & Demolition					
Mobilization	1	LS	$ 3,500.00	$ 16,000.00	Engineers Judgment
Demobilization	1	LS	$ 1,500.00	$ 13,000.00	Engineers Judgment
Subtotal				**$ 29,000.00**	
Erosion & Sediment Control					
Straw bales	100	LF	$ 7.00	$ 700.00	Recent Project Costs
Silt Fence	100	LF	$ 5.00	$ 500.00	Recent Project Costs
Maintenance	1	LS	$ 1,500.00	$ 1,500.00	Engineer's Judgment
Subtotal				**$ 2,700.00**	
Control of Water					
Engineering Design	1	LS	$ 7,500.00	$ 7,500.00	Recent Project Costs
Diversions	1	LS	$ 15,000.00	$ 15,000.00	Recent Project Costs
Dewtering	1	LS	$ 2,500.00	$ 2,500.00	
Subtotal				**$ 25,000.00**	
Sediment Management					
Sediment Removal	0	CY	$ 13.00	$ -	To Be Determined; Not Included
Exposrt Sediment	0	CY	$ 11.00	$ -	To Be Determined; Not Included
Subtotal				**$ -**	
Demolition					
Fish Ladder	60	CY	$ 350.00	$ 21,000.00	
Spillway Section	120	CY	$ 350.00	$ 42,000.00	
Subtotal				**$ 42,000.00**	
Channel Restoration					
Floodplain Fill Placement	50	CY	$ 1,400.00	$ 70,000.00	
Channel Creation	5	DAY	$ 3,500.00	$ 17,500.00	**Dam Site Only; Impoudment not included**
Subtotal				**$ 17,500.00**	
			SUBTOTAL	**$ 138,000.00**	(Rounded to the nearest $1,000)
			Contract Bonds	$ 2,000.00	1% of Project Subtotal
			Contingency	$ 42,000.00	30%
			OPINION OF TOTAL CONSTRUCTION COST (Base Work)	**$ 182,000.00**	
			Egineering, Design & Permitting	$ 120,000.00	
			Construction Phase Services Budget	$ 45,000.00	
			OPINION OF TOTAL CONSTRUCTION PHASE COST (Base Work)	**$ 347,000.00**	