DuBois & King inc.

ENGINEERING • PLANNING • DEVELOPMENT • MANAGEMENT

123269
July 1, 2016

Board of Selectmen
Town of New London
375 Main Street
New London, NH 03257-7813

SUBJECT: Pleasant Lake Dam Alternatives Summary Report

Attention: Kimberly Hallquist, Town Administrator

Introduction

Pleasant Lake Dam, located on a tributary to the Blackwater River in the Village of Elkins, New London, New Hampshire, is owned by the Town of New London (Owner). The dam is classified by the New Hampshire Department of Environmental Services, Dam Bureau as a High Hazard dam based on a recent Dam Breach Analysis conducted in 2011. The Dam Bureau issued a Letter of Deficiency (LOD) in September 2015 identifying several deficiencies requiring correction including inadequate safe discharge capacity of the dam during the High Hazard spillway design flood of the 2.5x100-year storm (Q2.5x100).

DuBois & King, Inc. (D&K) was retained by the Town of New London to conduct an evaluation of the Pleasant Lake Dam and provide alternatives for remedial action. The evaluation consisted of a site inspection, topographic survey, desktop analyses, and development of repair alternatives to address the identified deficiencies. This Summary Report details that evaluation and provides the owner with alternatives for remedial action to consider for implementation.

Field Investigations & Desktop Analysis

Site Inspection

Chandler Engel, PE and Shawn Patenaude, PE of D&K visited the site and inspected the dam on April 20th, 2016 in coordination with the D&K survey crew and Dam Bureau Engineer Charles Krautmann, PE. During that inspection D&K was able to identify and confirm the extent of the deficiencies listed in the LOD.

In general, the dam is in good condition with a few minor geometric deficiencies including a low area at the left abutment and an irregular crest shape. In addition, the block wall along the auxiliary spillway channel is exhibiting signs of deterioration and minor displacement.

Topographic Survey

A detailed topographic survey of the dam was performed by D&K's survey crew during the April 20, 2016 site visit. The survey was tied to the NH State plane, NAD83 horizontal datum and the NAVD88 vertical datum. From the surveyed information a topographic base map for the dam site was prepared with 1 foot contours. The base map is presented in Attachment A.

Hydrologic & Hydraulic (H&H) Analysis

Prior to project kickoff, D&K developed a hydrologic and hydraulic model of the watershed, lake and dam based on the best available information. The results from that model were used to develop the preliminary concepts presented in a proposal presented to the Town in March, 2016. The geometry of the dam, spillways and surrounding topography was subsequently updated with information from the high-resolution survey data collected in April 2016.

The lake has an 11 square mile watershed and from that area approximately 5,000 cubic feet per second of inflowing discharge is anticipated at the peak of a 100 year flood event, which results in a Q2.5x100 of 12,500 cubic feet per second. The dam has a 42 inch gated culvert primary spillway below the gatehouse, a 56 foot wide auxiliary spillway near the right abutment and 40 foot wide low paved area at the boatramp along the right abutment. The current crest of the dam is irregular, ranging from El. 806.9 ft in the low spot near the left abutment to El. 807.8 ft at the high point near the gatehouse.

The results of the H&H analysis show that, under existing conditions, the flow associated Q2.5x100 year storm overtops the dam embankment by 0.4 – 1.4 feet at various locations along the crest. For reference, the next smaller storm considered, the 500-year event, resulted in a peak water elevation within a few tenths of a foot below the crest, with minor overtopping near the left abutment. The 100-year event is safely passed with more than 1 foot of freeboard.

A dam is considered to have adequate hydraulic capacity if it can pass the spillway design flood with 1 foot of freeboard between the peak water surface and any non-overflow, erodible portions of the dam. The Pleasant Lake dam does not have adequate hydraulic capacity to pass the Q2.5x100 storm with 1 foot of freeboard.

A summary table of the H&H analysis results are presented in Attachment B.

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Alternatives Analysis

Following the review of the topographic survey and the results of the existing conditions H&H analysis, D&K advanced the three conceptual alternatives. For each alternative, D&K modeled the hydraulic performance and estimated quantities and costs for equipment, material and labor.

A handful of minor deficiencies will be addressed regardless of the selected alternative, including:

- Low spot in the crest: The low area near the left abutment is a potential flow path that is not protected against erosion. All alternatives include the extension of the existing earth embankment across the low spot to create a uniform crest elevation.
- Irregular crest: All alternatives will include provisions for regrading the crest and restoring a uniform shape and elevation.
- Auxiliary spillway channel block wall: All alternatives will include a detail for structurally connecting the blocks by dowelling them together with steel bars.

Alternatives to Address Hydraulic Capacity

The existing spillway configuration does not have adequate capacity to pass the Q2.5x100 storm with 1 foot of freeboard, as required by NHDES Dam Bureau. Three (3) alternatives to address the hydraulic capacity issue were developed and are presented for consideration.

In each of the alternatives, the discharge or storage capacity of the dam will be modified to allow for safe discharge of the Q2.5x100 storm with 1 foot of freeboard to non-overflow portions of the dam.

Alternative 1 ~ Raise Dam Crest with Parapet Wall

Involves installing a concrete parapet wall on the crest of the dam.

Major Components

- Parapet wall installed along 300 foot long length of crest, extending from the Auxiliary Spillway to the left abutment.
- The top of the approximately 2.5 foot tall wall will be 1 foot higher than the calculated peak water level during the Q2.5x100 storm event.
- Wall can be textured to appear stone-like with the use of form liners to blend the wall into the existing dam aesthetic.

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Primary Benefits

- Only crest of dam disturbed.
- Reduces discharge from the dam during high event, providing some flood mitigation downstream

Primary Drawbacks

- Parapet wall will increase the storage capacity of the dam during events larger than the 500-year storm. Water surface elevations in the lake will be higher during those events than under other alternatives, e.g. the Q2.5x100 will result in a 0.2 ft lake level increase over existing conditions.
- Sight lines of the lake may be obstructed by the wall in some locations.
- More flow will be directed through the auxiliary spillway and boat ramp area.

Cost

- Anticipated construction cost of $405,000

Alternative 2 ~ Armor Crest

Involves excavating the crest of the dam and installing articulated concrete blocks (ACBs) which resist erosive forces.

Major Components

- ACBs installed along 240 foot long section of the crest of dam.
    - ACBs Terminate before entering area of “old ground” with large pine trees. Some roots will be removed to accommodate ACBs but trees will remain.
    - ACBs installed on face of dam between trees and gatehouse.
    - ACBs installed on face of dam between gatehouse and new embankment on left abutment.
- All ACBs covered with soil and seeded to restore site appearance
- Crest of dam leveled to consistent elevation (approximately El. 807.5 ft)
- Grouted riprap installed in a “U” shape below gatehouse and on channel banks to protect against erosion during overtopping event.
- Area under gatehouse protected with granite slabs or similar

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Primary Benefits

- Extreme flood waters can overtop dam, but embankment is protected from erosion.
- Lake stages under all storm conditions remain essentially unchanged.
- Sightlines remain as they are currently

Primary Drawbacks

- Following a storm event overtopping the dam (>500-year), grass and soil will likely eroded to the face of the blocks.
- Gate house is not protected from overtopping flow.
- Significant amount of site work.

Cost

- Anticipated construction cost of $440,000

Alternative 3 ~ Partial Raise with Parapet wall and Armoring Crest

Involves installing a parapet wall on a portion of the crest and installing articulated concrete blocks (ACBs) on unprotected sections.

Major Components

- Parapet wall installed along 170 foot long length of crest, extending from the Auxiliary Spillway to the gatehouse. A return wall will direct flow around the gatehouse structure.
- The top of the approximately 2.5 foot tall wall will be 1 foot higher than the calculated peak water level during the Q2.5x100 storm event.
- The parapet wall will form the back wall of the gatehouse structure.
- Parapet wall will only hold back additional water during storm events larger than the 500-year event.
- ACBs installed along 70 foot long crest of dam from the gatehouse to the new embankment on left abutment.
- All ACBs covered with soil and seeded to restore site appearance
- Grouted riprap installed in a “L” shape below gatehouse and on the east channel bank to protect against erosion during overtopping event.

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Primary Benefits

- Extreme flood waters can overtop part of the dam, but embankment is protected from erosion.
- Provides some flood mitigation downstream by reducing the dam discharge during extreme events.
- Less impact on downstream face of dam.

Primary Drawbacks

- Parapet wall will increase the storage capacity of the dam during events larger than the 500-year storm. Water surface elevations in the lake will be higher during those events than with Alternative #2.
- More flow will be directed through the auxiliary spillway and boat ramp area.
- Following a storm event overtopping the dam (>500-year), grass and soil will likely eroded to the face of the blocks.
- Significant amount of site work.

Cost

- Anticipated construction cost of $485,000

An engineering sketch, estimate of probable construction costs and a comparative matrix are presented in Attachment C.

Conclusion and Recommendations

The dam is in generally good condition, although the current spillway hydraulic capacity is inadequate to pass the spillway design flood for High Hazard dams, and therefore requires implementation of remedial measures. Through our alternatives analysis three (3) viable alternatives were identified. All alternatives achieve the objective of safely passing the spillway design flood (Q2.5x100) while protecting the dam from overtopping. These alternatives also address the additional minor deficiencies identified in the Dam Bureau's LOD including the irregular embankment geometry and the auxiliary spillway channel wall blocks.

Alternative 1 involves installation of a parapet wall. This is a simple cost effective solution with minimal impact to the dam site. The major considerations are the impact to lake levels during storm events greater than the 500-year event (up to 0.2 ft additional lake stage), and the impact of the wall on sightlines of the lake.

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Alternative 2 involves leveling the dam crest to a consistent height and armoring the embankment to prevent erosion during overtopping. This is alternative requires a significant amount of site work.

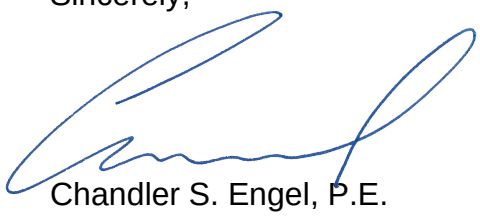
Alternative 3 involves installing a parapet wall to prevent flow passing through the treed area, and through the gatehouse while utilizing the area to the east of the gatehouse as a flow path by armoring the crest .

The cost difference between Alternatives 1 and Alternatives 2&3 is significant. From an economic perspective Alternative 1 is the logical choice, however it comes with a few potential drawbacks that should be carefully considered. To reiterate, these drawbacks include adding potential storage to the reservoir which could result in additional flooding around the lake during extreme events, and impact to sightlines of the lake. Alternative 2 would not significantly change the potential lake elevations during extreme events, and the dam would largely remain unchanged in appearance, however this comes at a cost premium. Alternative 3 is the most expensive option and while it would slightly reduce the degree of lake rise during extreme events relative to Alternative 1, the combination of the drawbacks and cost lead this to be the weakest alternative. DuBois & King recommends that the Town consider implementing Alternative 1 or 2 based on the benefits and drawbacks presented in this report.

Once you have a chance to review this summary report and discuss the findings and recommendations, D&K is prepared to attend a meeting with the Town to further discuss the details of our work, outline next steps and answer any questions that may arise.

We appreciate the opportunity to assist you with this project. Please email, or call me at (802) 728-3376 if you have any questions or need any additional information.

Sincerely,



Chandler S. Engel, P.E.
Project Manager
DuBois & King, Inc.

Attachments:

- A – Basemap
- B – Hydrology & Hydraulics
- C – Alternatives (Exhibits/Costs/Matrix)

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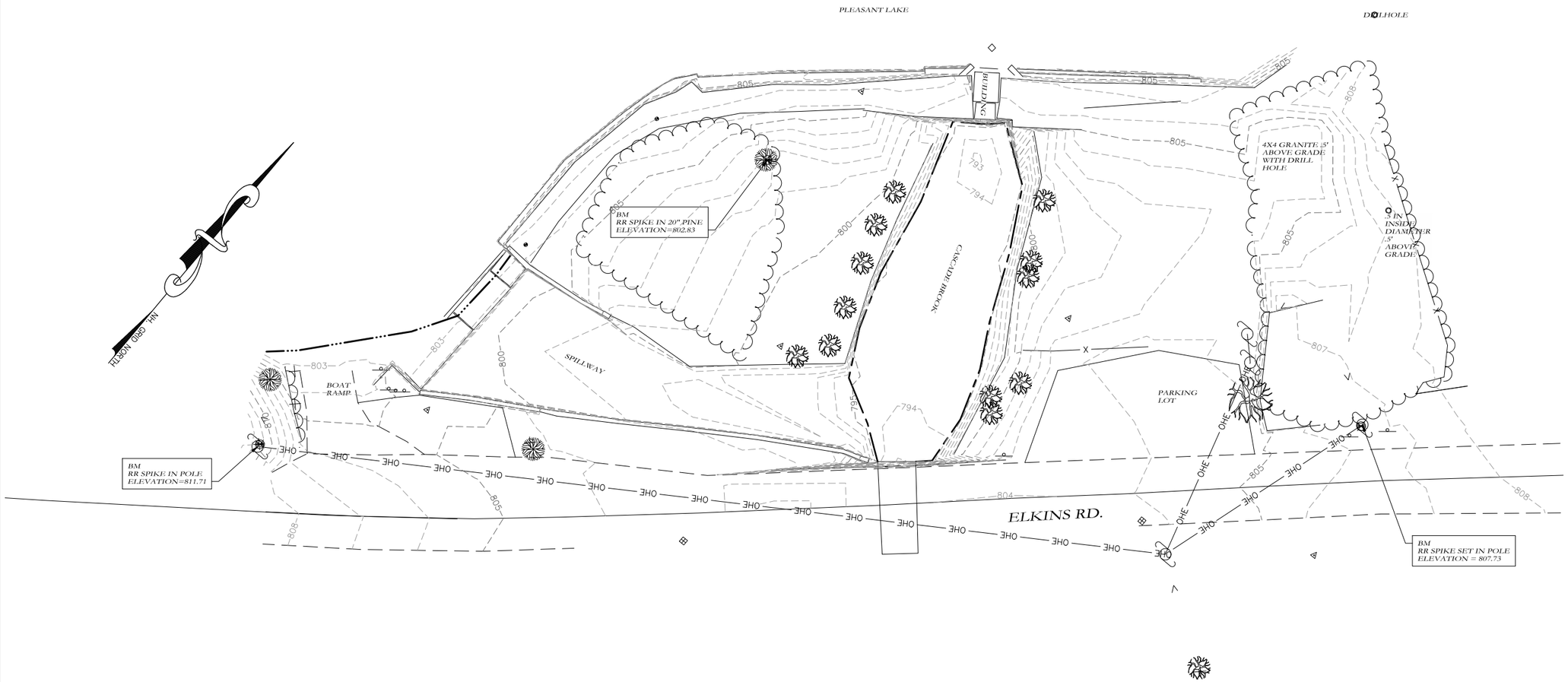
Attachment A

Basemap



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PROFESSIONAL SEAL

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NO.	DESCRIPTION	DATE	BY	CK'D

TOWN OF NEW LONDON
375 MAIN STREET
NEW LONDON, NEW
HAMPSIRE 03257

PLEASANT LAKE DAM ALTERNATIVES ANALYSIS

SHEET TITLE

EXISTING CONDITIONS

SITE PLAN

DRAWN BY	DATE
EBS	JUNE 2016
CHECKED BY	D&K PROJECT #
	123269
PROJ. ENG.	D&K ARCHIVE #
CSE	

SHEET NUMBER

SHEET OF 4

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Attachment B

Hydrology and Hydraulics Summary

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Laconia, NH (603) 883-0463
South Burlington, VT (802) 878-7661
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JOB Pleasant Lake Dam
SHEET NO. 1 OF 1
CALCULATED BY: CSE DATE: 7/1/2016
CHECKED BY: DATE:
SCALE:

PLEASANT LAKE DAM

ALTERNATIVES ANALYSIS

HYDRAULIC PERFORMANCE SUMMARY

Key Elevations

Existing Top of Dam El.	807.5	ft.	@300' Long
Primary Spillway El.	796.0	ft.	42" Gated Pipe
Auxiliary Spillway El.	A 803.1	ft.	@ 20' Long
	B 804.1	ft.	@ 36' Long
Normal Water Level	803.0	ft.	
Roadway El.	803.9	ft.	

Key H&H Data

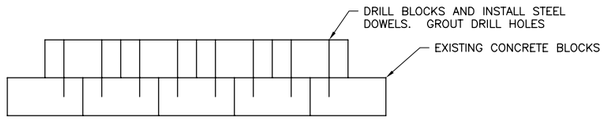
Drainage Area:	11.1	mi^2
Event Inflows		
Q100	5,000	cfs
Q500	9,400	cfs
Q2.5x100	12,500	cfs

Storm Event			Hydraulic Performance: Peak Inflow	Peak WSEL	Lake Level Rise	Freeboard to Top of Dam	Peak Dam Discharge	Tailwater El.	Rt 11 Freeboard
			cfs	ft	ft	ft	cfs	ft	ft
Existing Conditions		Q100-yr (6.6 in/24hrs)	5,000	805.7	2.7	1.8	417	798.5	5.3
		Q500-yr (9.7in/24hrs)	9,400	807.2	4.2	0.3	1,159	804.0	-0.1
		Q2.5x100-yr Inflow	12,500	808.2	5.2	-0.7	2,493	805.5	-1.7
Alt. 1 (Raise)	Raise to El. 809.5	Q100-yr (6.6 in/24hrs)	5,000	805.7	2.7	3.8	417	798.5	5.3
		Q500-yr (9.7in/24hrs)	9,400	807.2	4.2	2.3	1,145	803.9	-0.1
		Q2.5x100-yr Inflow	12,500	808.4	5.4	1.1	2,009	805.2	-1.3
Alt. 2 (Armor)	Crest Leveled to El. 807.5	Q100-yr (6.6 in/24hrs)	5,000	805.7	2.7	3.8	417	798.5	5.3
		Q500-yr (9.7in/24hrs)	9,400	807.2	4.2	2.3	1,145	803.9	-0.1
		Q2.5x100-yr Inflow	12,500	808.3	5.3	1.2	2,324	805.4	-1.5
Alt. 3 (Raise/Armor)	Armor Left, Raise Right	Q100-yr (6.6 in/24hrs)	5,000	805.7	2.7	3.8	417	798.5	5.3
		Q500-yr (9.7in/24hrs)	9,400	807.2	4.2	2.3	1,145	803.9	-0.1
		Q2.5x100-yr Inflow	12,500	808.4	5.4	1.1	2,114	805.2	-1.4

Print Date: 7/1/2016

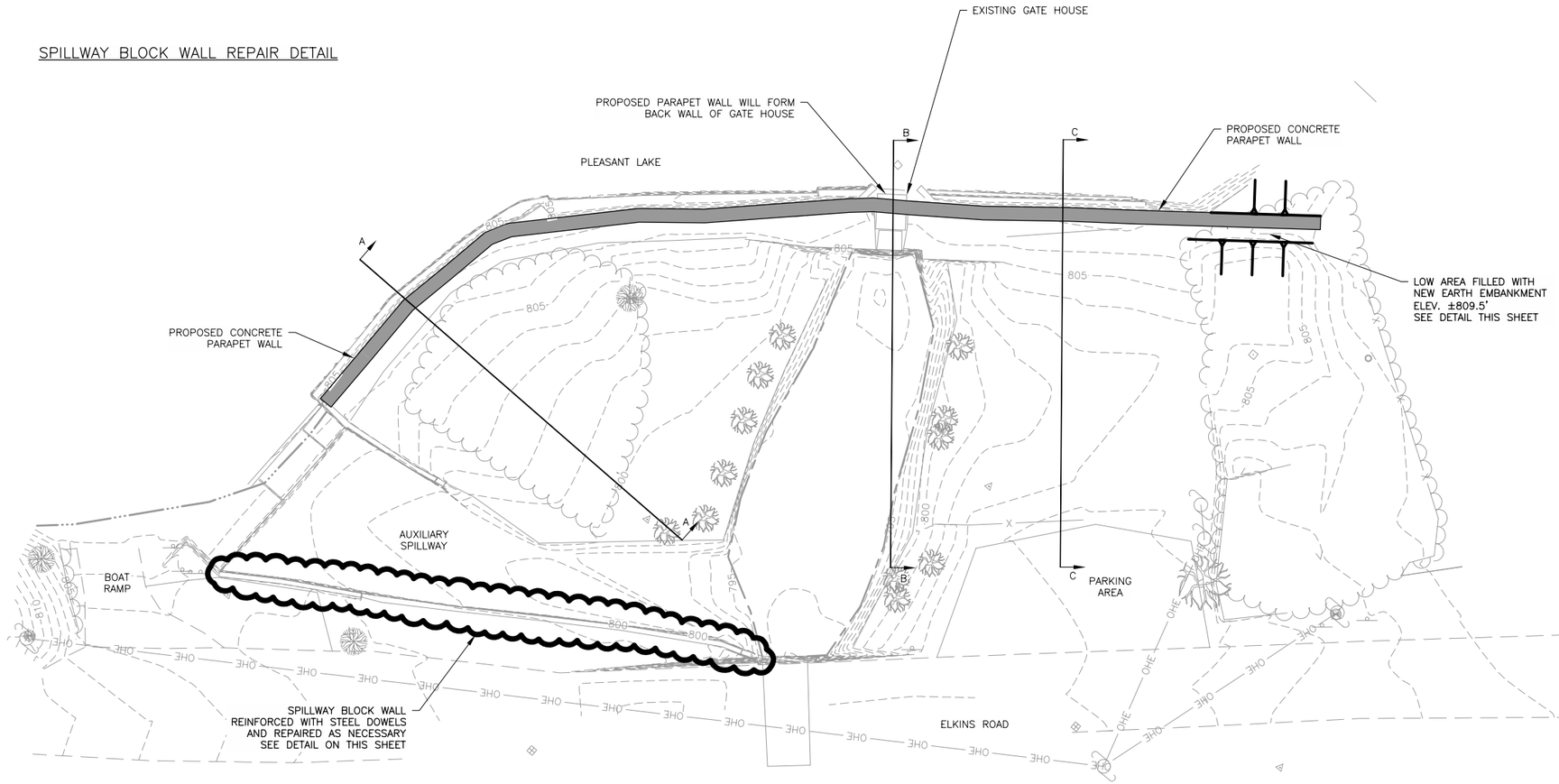
Attachment C

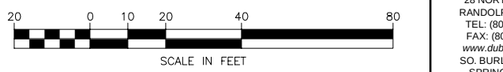
Alternatives (Exhibits/Costs/Matrix)



SPILLWAY BLOCK WALL REPAIR DETAIL

ALTERNATIVE #1
RAISE DAM CREST WITH PARAPET WALL



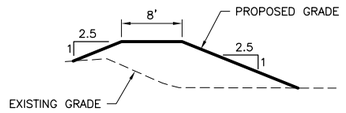


LEGEND

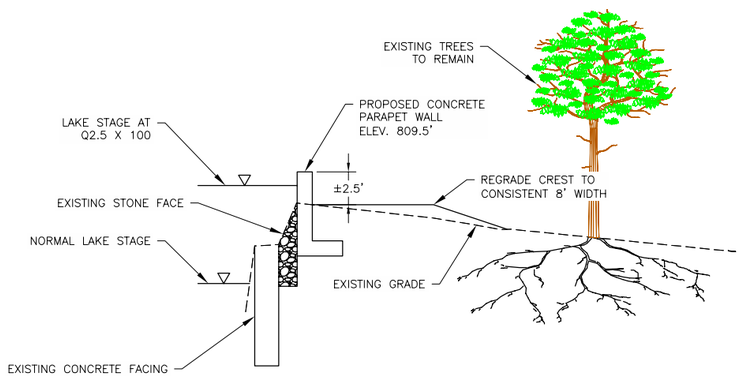
- RIGHT OF WAY LIMITS
- MINOR CONTOUR
- MAJOR CONTOUR
- EDGE OF PAVEMENT
- OHE&T — OVERHEAD COMMUNICATIONS CABLE
- UGE — UNDERGROUND UTILITY LINE
- MH — UNDERGROUND STEAM
- W — WATER LINE
- CONCRETE SIDEWALK
- ASPHALT CURB
- UGT / UGE — APPROXIMATE UNDERGROUND COMMUNICATION LINE
- GROUNDWATER TREATMENT LINE
- CATCH BASIN
- HARD WOOD TREE
- SHRUB
- GUY ANCHOR
- COMBO
- SIGN
- BENCH MARK
- OVERHEAD LIGHTING
- HVCTRL
- GATE VALVE
- MONITORING WELL
- SEWER MANHOLE

CONCEPTUAL CONSTRUCTION SEQUENCE:

* REINFORCE AUXILIARY SPILLWAY BLOCK WALL
* INSTALL EARTH EMBANKMENT AT LEFT ABUTMENT
* INSTALL CONCRETE PARAPET WALL FROM AUXILIARY SPILLWAY TO LEFT ABUTMENT



EMBANKMENT SECTION



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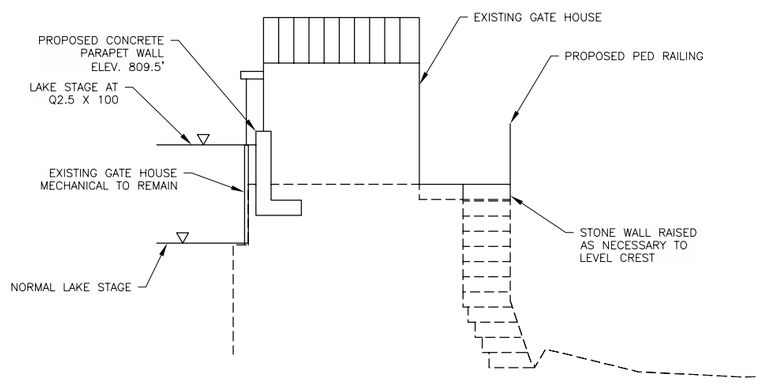

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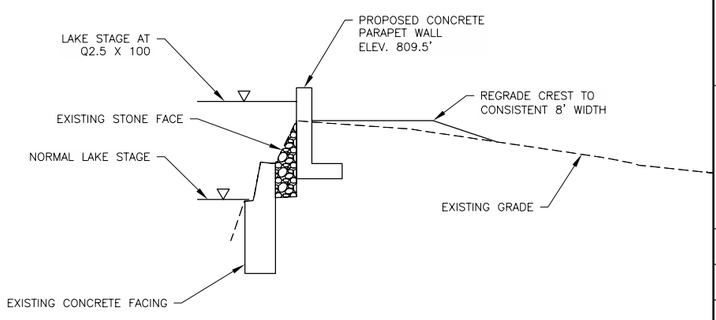

SECTION C–C

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NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF NEW LONDON
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NEW LONDON, NEW HAMPSIRE 03257

PLEASANT LAKE DAM ALTERNATIVES ANALYSIS

SHEET TITLE

PROPOSED CONDITIONS PLAN ALTERNATIVE #1

DRAWN BY	DATE
MPH	JUNE 2016
CHECKED BY	D&K PROJECT #
	123269
PROJ. ENG.	D&K ARCHIVE #
CSE	

SHEET NUMBER

1

SHEET OF 4

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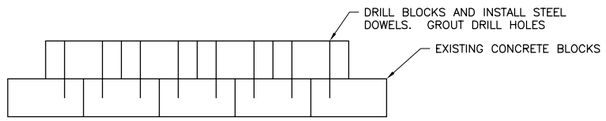
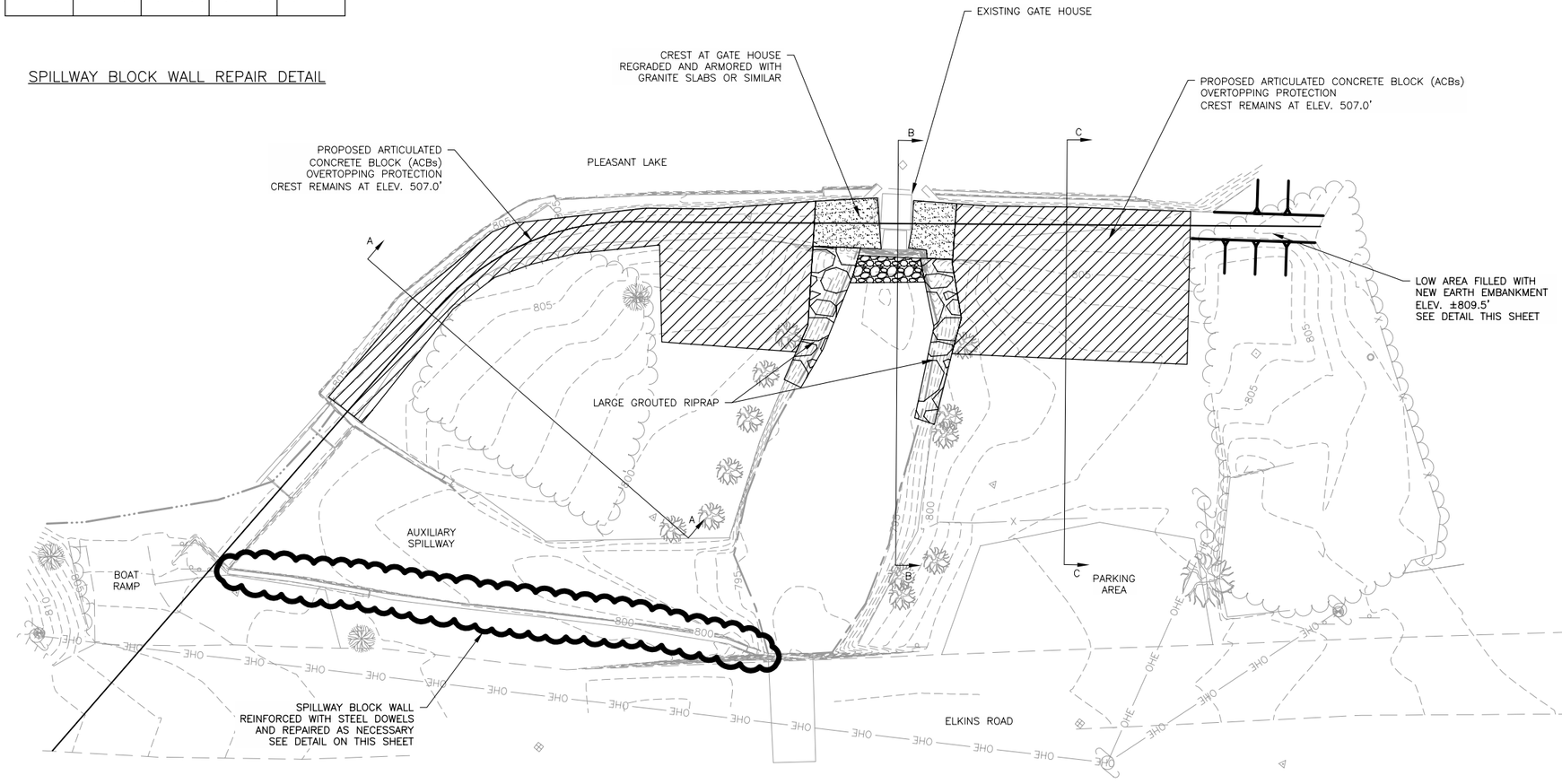


SPILLWAY BLOCK WALL REPAIR DETAIL

ALTERNATIVE #2
ARMOR CREST



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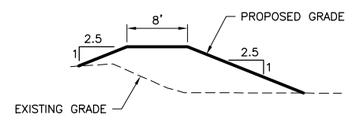
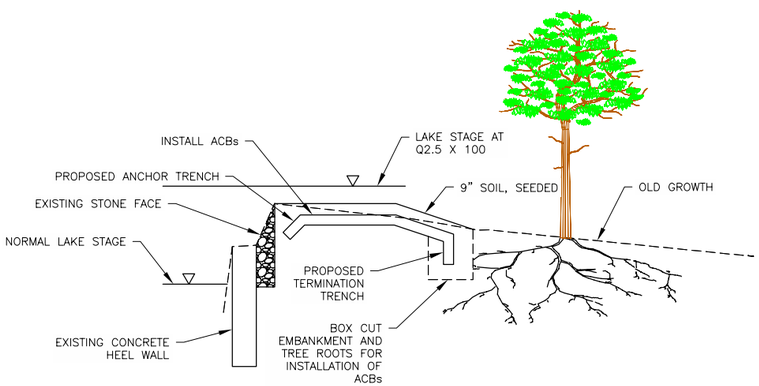
- BENCH MARK
- OVERHEAD LIGHTING
- HVCTRL
- GATE VALVE
- MONITORING WELL
- SEWER MANHOLE

CONCEPTUAL CONSTRUCTION SEQUENCE:

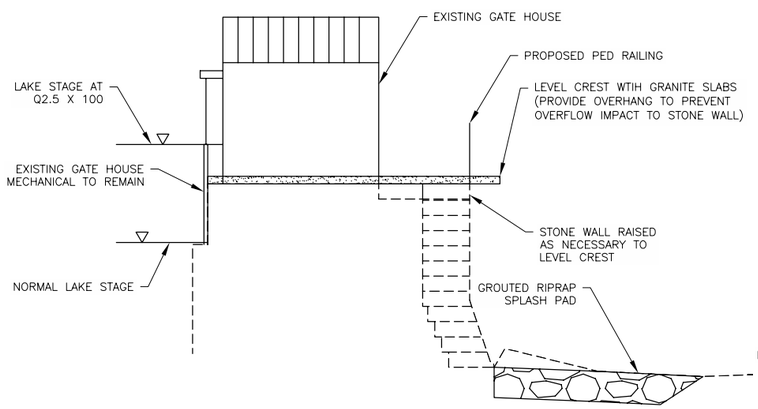
* REINFORCE AUXILIARY SPILLWAY BLOCK WALL
* INSTALL EARTH EMBANKMENT AT LEFT ABUTMENT
* EXCAVATE CREST AND DAM FACE TO PREPARE FOR ACB INSTALLATION
* INSTALL ACBs
* REGRADE CREST AROUND GATE HOUSE AND INSTALL GRANITE SLABS OR SIMILAR TO PROTECT CREST
* INSTALL GROUND RIPRAP BELOW GATE HOUSE WALL AND ON CHANNEL BANKS
* COVER ACBs WITH SOIL, SEED AND MULCH



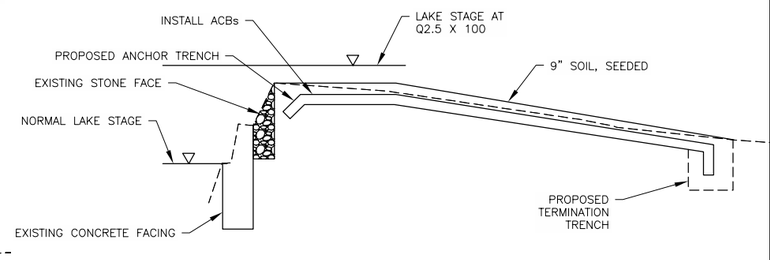
EMBANKMENT SECTION



SECTION A



SECTION B



SECTION C

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DRAWN BY	DATE
MPH	JUNE 2016
CHECKED BY	D&K PROJECT #
	123269
PROJ. ENG.	D&K ARCHIVE #
CSE	

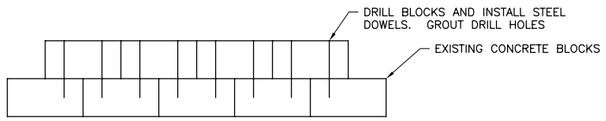
SHEET NUMBER

2

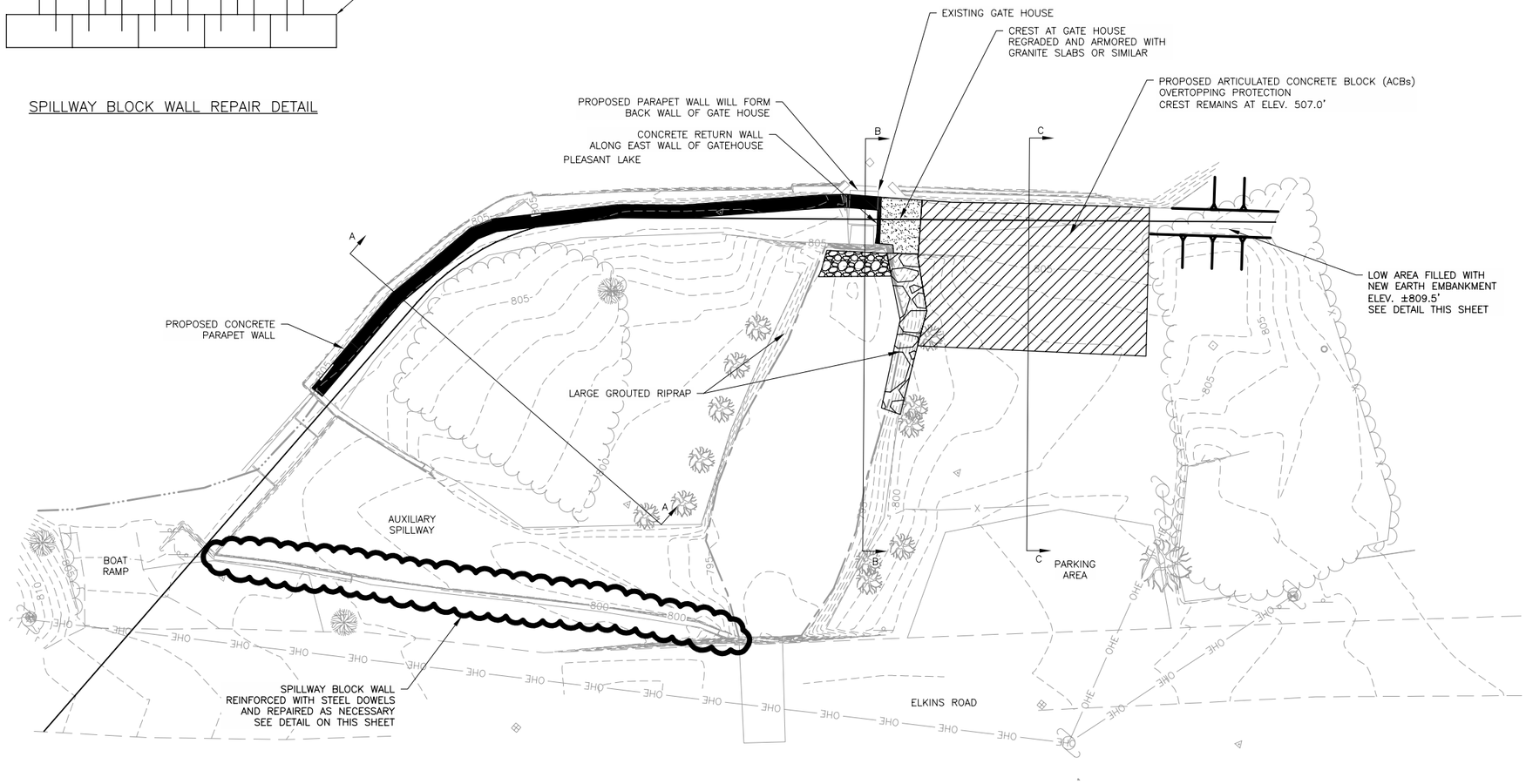
SHEET OF 4

I:\123269 Pleasant Lake Dam\dwg\20160624 – Alternatives Analysis.dwg 6/29/2016 4:15 PM

ALTERNATIVE #3
PARTIAL RAISE WITH PARAPET WALL AND ARMORING CREST



SPILLWAY BLOCK WALL REPAIR DETAIL



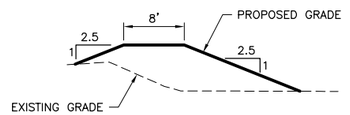
SCALE IN FEET: 20 0 10 20 40 80

LEGEND

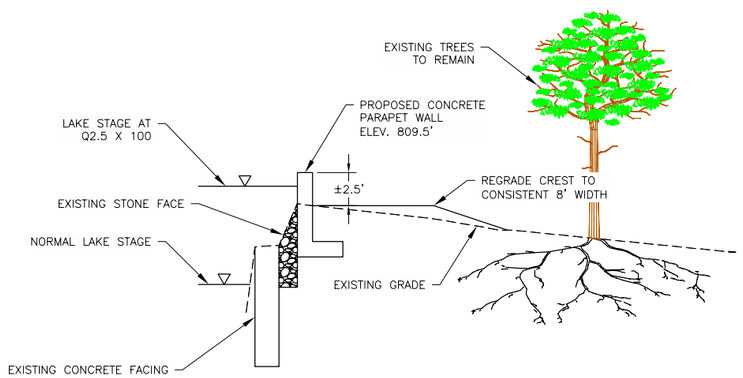
- RIGHT OF WAY LIMITS
- MINOR CONTOUR
- MAJOR CONTOUR
- EDGE OF PAVEMENT
- OHE&T — OVERHEAD COMMUNICATIONS CABLE
- UGE — UNDERGROUND UTILITY LINE
- MH — UNDERGROUND STEAM
- W — WATER LINE
- CONCRETE SIDEWALK
- ASPHALT CURB
- UGT / UGE — APPROXIMATE UNDERGROUND COMMUNICATION LINE
- GROUNDWATER TREATMENT LINE
- CATCH BASIN
- HARD WOOD TREE
- SHRUB
- GUY ANCHOR
- COMBO
- SIGN
- BENCH MARK
- OVERHEAD LIGHTING
- HVCTRL
- GATE VALVE
- MONITORING WELL
- SEWER MANHOLE

CONCEPTUAL CONSTRUCTION SEQUENCE:

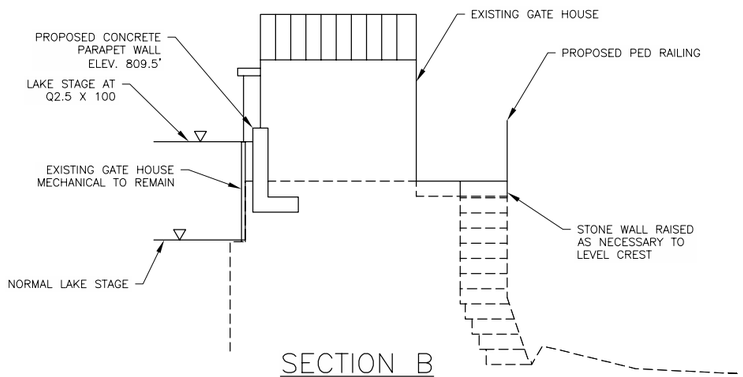
* REINFORCE AUXILIARY SPILLWAY BLOCK WALL
* INSTALL EARTH EMBANKMENT AT LEFT ABUTMENT
* EXCAVATE CREST AND DAM FACE, TO EAST OF GATEHOUSE, TO PREPARE FOR ACB INSTALLATION
* REGRADE CREST AT GATEHOUSE
* INSTALL ACBs
* REGRADE CREST AROUND GATE HOUSE AND INSTALL GRANITE SLABS OR SIMILAR TO PROTECT CREST
* INSTALL GROUND RIPRAP ALONG CHANNEL EDGE ADN BELOW GATEHOUSE WALL
* COVER ACBs WITH SOIL, SEED AND MULCH
* INSTALL CONCRETE PARAPET WALL FROM AUXILIARY SPILLWAY TO EAST WALL OF GATEHOUSE



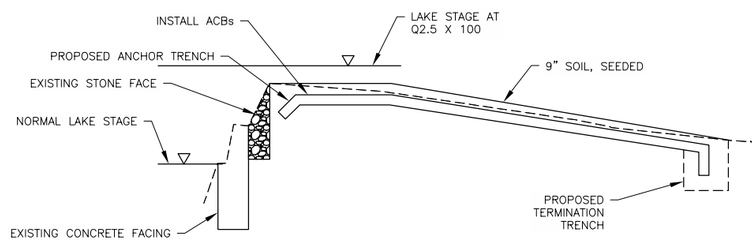
EMBANKMENT SECTION



SECTION A



SECTION B



SECTION C

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LACONIA, NH

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION PRELIMINARY PLANS

NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF NEW LONDON
375 MAIN STREET
NEW LONDON, NEW HAMPSIRE 03257

PLEASANT LAKE DAM ALTERNATIVES ANALYSIS

SHEET TITLE

PROPOSED CONDITIONS PLAN ALTERNATIVE #3

DRAWN BY	DATE
MPH	JUNE 2016
CHECKED BY	D&K PROJECT #
	123269
PROJ. ENG.	D&K ARCHIVE #
CSE	

SHEET NUMBER

3

SHEET OF 4

I:\123269 Pleasant Lake Dam\dwg\20160624 – Alternatives Analysis.dwg 6/29/2016 4:13 PM

Town of New London
Pleasant Lake Dam
New London, New Hampshire

Opinion of Probable Construction Costs
Conceptual Design Estimate ~ Alternative 1. Parapet Wall

Scope of Design: Install a concrete parapet wall on exsisting crest to increase storage and freeboard during events >500-year.

ITEM NO.	DESCRIPTION	UNITS	ENGINEER'S ESTIMATED QUANTITY	UNIT COST	TOTAL
GENERAL					
1	Mobilization (Assume 10% of Construction Costs)	LS	1	$ 29,240.00	$ 29,240
2	Survey Layout	DAY	1	$ 5,000.00	$ 5,000
3	Control of Water (Cofferdam, Dewatering, Bypass, and Refilling)	LS	1	$ 10,000.00	$ 10,000
4	Clearing and Grubbing	LS	1	$ 5,000.00	$ 5,000
5	Erosion Prevention and Sediment Control	LS	1	$ 10,000.00	$ 10,000
6	Landscape Restoration	LS	1	$ 10,000.00	$ 10,000
				GENERAL SUBTOTAL	$ 69,240
OVERTOPPING PROTECTION					
7	General Excavation	CY	500	$ 30	$ 15,000
8	Dam Embankment Material	CY	300	$ 80	$ 24,000
9	Parapet Wall - Concrete	CY	160	$ 1,000	$ 160,000
10	Parapet Wall Cap (Granite)	LF	300	$ 60	$ 18,000
11	Gatehouse Retrofit (Wall, Railing, Level Crest)	LS	1	$ 15,000	$ 15,000
				OVERTOPPING PROTECTION SUBTOTAL	$ 232,000
LEFT ABUTMENT EMBANKMENT					
11	Dam Embankment Material	CY	130	$ 80	$ 10,400
				LEFT ABUTMENT EMBANKMENT SUBTOTAL	$ 10,400
AUXILIARY SPILLWAY WALL					
12	Repair Block Wall	LS	1	$ 10,000	$ 10,000
				AUXILIARY SPILLWAY WALL SUBTOTAL	$ 10,000

CONSTRUCTION ITEMS SUB-TOTAL (rounded to nearest $100)	=	$321,700
ADD 25% CONTINGENCY	=	$80,425
TOTAL CONSTRUCTION COST	=	**$402,125**

Estimate Prepared By :	CSE
Estimate Preparation Date :	1-Jul-16
Checked by:	
Estimate Print Date:	1-Jul-16

Town of New London
Pleasant Lake Dam
New London, New Hampshire

Opinion of Probable Construction Costs
Conceptual Design Estimate ~ Alternative 2. Armor Crest

Scope of Design: Armor crest to prevent overtopping damage during events >500-year.

ITEM NO.	DESCRIPTION	UNITS	ENGINEER'S ESTIMATED QUANTITY	UNIT COST	TOTAL
GENERAL					
1	Mobilization (Assume 10% of Construction Costs)	LS	1	$ 31,740.00	$ 31,740
2	Survey Layout	DAY	1	$ 5,000.00	$ 5,000
3	Control of Water (Cofferdam, Dewatering, Bypass, and Refilling)	LS	1	$ 10,000.00	$ 10,000
4	Clearing and Grubbing	LS	1	$ 5,000.00	$ 5,000
5	Erosion Prevention and Sediment Control	LS	1	$ 10,000.00	$ 10,000
6	Landscape Restoration	LS	1	$ 20,000.00	$ 20,000
				GENERAL SUBTOTAL	$ 81,740
OVERTOPPING PROTECTION					
7	Articulated Concrete Blocks	SF	10,000	$ 20	$ 200,000
8	StoneFill Type IV Grouted	CY	220	$ 100	$ 22,000
9	Gatehouse Retrofit (Level Crest w/ granite slabs, Railing)	LS	1	$ 25,000	$ 25,000
				OVERTOPPING PROTECTION SUBTOTAL	$ 247,000
LEFT ABUTMENT EMBANKMENT					
10	Dam Embankment Material	CY	130	$ 80	$ 10,400
				LEFT ABUTMENT EMBANKMENT SUBTOTAL	$ 10,400
AUXILIARY SPILLWAY WALL					
11	Repair Block Wall	LS	1	$ 10,000	$ 10,000
				AUXILIARY SPILLWAY WALL SUBTOTAL	$ 10,000

CONSTRUCTION ITEMS SUB-TOTAL (rounded to nearest $100)	=	$349,200
ADD 25% CONTINGENCY	=	$87,300
TOTAL CONSTRUCTION COST	=	**$436,500**

Estimate Prepared By :	CSE
Estimate Preparation Date :	1-Jul-16
Checked by:	
Estimate Print Date:	1-Jul-16

Town of New London
Pleasant Lake Dam
New London, New Hampshire

Opinion of Probable Construction Costs
Conceptual Design Estimate ~ Alternative 3. Parapet Wall and Armor Crest

Scope of Design: Install a concrete parapet wall on exsisting crest to increase storage and freeboard to the west of the Gatehouse and armor crest to prevent overtopping damage to the right of the crest (during events >500-year).

ITEM NO.	DESCRIPTION	UNITS	ENGINEER'S ESTIMATED QUANTITY	UNIT COST	TOTAL
GENERAL					
1	Mobilization (Assume 10% of Construction Costs)	LS	1	$ 35,140.00	$ 35,140
2	Survey Layout	DAY	1	$ 5,000.00	$ 5,000
3	Control of Water (Cofferdam, Dewatering, Bypass, and Refilling)	LS	1	$ 10,000.00	$ 10,000
4	Clearing and Grubbing	LS	1	$ 5,000.00	$ 5,000
5	Erosion Prevention and Sediment Control	LS	1	$ 10,000.00	$ 10,000
6	Landscape Restoration	LS	1	$ 20,000.00	$ 20,000
				GENERAL SUBTOTAL	$ 85,140
OVERTOPPING PROTECTION					
7	Articulated Concrete Blocks	SF	5,000	$ 20	$ 100,000
8	StoneFill Type IV Grouted	CY	130	$ 100	$ 13,000
9	Gatehouse Retrofit (Level Crest w/ granite slabs, Railing)	LS	1	$ 25,000	$ 25,000
10	General Excavation	CY	300	$ 30	$ 9,000
11	Dam Embankment Material	CY	150	$ 80	$ 12,000
12	Parapet Wall - Concrete	CY	110	$ 1,000	$ 110,000
13	Parapet Wall Cap (Granite)	LF	200	$ 60	$ 12,000
				OVERTOPPING PROTECTION SUBTOTAL	$ 281,000
LEFT ABUTMENT EMBANKMENT					
10	Dam Embankment Material	CY	130	$ 80	$ 10,400
				LEFT ABUTMENT EMBANKMENT SUBTOTAL	$ 10,400
AUXILIARY SPILLWAY WALL					
11	Repair Block Wall	LS	1	$ 10,000	$ 10,000
				AUXILIARY SPILLWAY WALL SUBTOTAL	$ 10,000

CONSTRUCTION ITEMS SUB-TOTAL (rounded to nearest $100)	=	$386,600
ADD 25% CONTINGENCY	=	$96,650
TOTAL CONSTRUCTION COST	=	**$483,250**

Estimate Prepared By :	CSE
Estimate Preparation Date :	1-Jul-16
Checked by:	
Estimate Print Date:	1-Jul-16

Pleasant Lake Dam
New London, NH
Hydraulic Capacity - Alternatives Matrix

Alternative	Primary Objective	Major Components	Approximate Cost	Primary Benefits	Primary Drawbacks
Alternative #1 Raise Dam Crest with Parapet Wall	Prevent overtopping by increasing lake storage and crest freeboard	Install +/- 2.5 ft tall concrete parapet wall along entire crest	$405,000	Only crest of dam disturbed. Reduces discharge from the dam during high event, providing some flood mitigation downstream.	Parapet wall will increase the storage capacity of the dam during events larger than the 500-year storm. Water surface elevations in the lake will be higher during those events than under Alternative #2, e.g. the Q2.5x100 will result in a 0.2 ft lake level increase over existing conditions. Sight lines of the lake may be obstructed by the wall in some locations. More flow will be directed through the auxiliary spillway and boat ramp area.
Alternative #2 Armor Crest with Articulated Concrete Blocks	Prevent erosion of crest during overtopping by armoring crest	Install articulated concrete blocks on entire crest and face of dam fill.	$440,000	Extreme flood waters can overtop dam, but embankment is protected from erosion. Lake stages under all storm conditions remain essentially unchanged. Sightlines remain as they are currently	Following a storm event overtopping the dam (>500-year), grass and soil will likely eroded to the face of the blocks. Gate house is not protected from overtopping flow. Significant amount of site work.
Alternative #3 Partially Raise with Parapet and Armor Crest	Prevent overtopping to the west of the gatehouse and armor crest from erosion to the east of the gatehouse	Install +/- 2.5 ft tall concrete parapet wall from auxiliary spillway to gatehouse. Install articulated concrete blocks crest and face of dam to the east of gate house.	$485,000	Extreme flood waters can overtop part of the dam, but embankment is protected from erosion. Provides some flood mitigation downstream by reducing the dam discharge during extreme events. Less impact on downstream face of dam vs. Alternative #2.	Parapet wall will increase the storage capacity of the dam during events larger than the 500-year storm. Water surface elevations in the lake will be higher during those events than under Alternative #2, e.g. the Q2.5x100 will result in a slightly less than 0.2 ft lake level increase over existing conditions. More flow will be directed through the auxiliary spillway and boat ramp area. Following a storm event overtopping the dam (>500-year), grass and soil will likely eroded to the face of the blocks. Significant amount of site work.