POST-GLACIAL STRATIGRAPHY AND HUMAN IMPACTS IN UPPER BOLTON LAKE, EASTERN CONNECTICUT: IMPLICATIONS FOR AN ATLANTIC WHITE CEDAR STAND

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ABSTRACT

This thesis presents the results of an investigation of Upper Bolton Lake (UBL) in eastern Connecticut, located in the headwaters (205 m elevation) of the Hop River. The Hop River is a tributary of the Willimantic River and part of Thames River watershed in eastern Connecticut. UBL is shallow (<2.3 m) and is the northernmost of three connected lakes, the others being Middle and Lower Bolton Lakes. Each lake has been dammed as a water reservoir, creating a ~200-year history of anthropogenic fluctuations in lake levels. UBL transitions into a unique tree stand of Atlantic White Cedar (AWC) in its northeast portion. Presently, Upper Bolton Lake is dammed at its southern edge by a causeway and culvert system, which will be replaced in the Fall of 2019. There is some local concern that the lake level could change as a result of culvert renovations, and that this change may have an effect on the AWC stand. This inspired an investigation into the historical context and natural state of this site.

This project consisted of sub-surface sampling and a historical records review. Samples collected using a macaulay peat probe were collected in two locations and reached ~8 m below surface, while two vibracores were collected which recovered ~1 m of material. These samples were described in the field and lab using Official Soil Series Descriptions (OSDs) by the Natural Resources Conservation Service (NRCS). Samples were tested for organic content (measured by loss-on-ignition) and ^{14}C dated. A GPR survey was conducted outside of the tree stand to reaffirm findings from sampling. Two wood fragments were described from the macaulay samples. The sampling conducted captures an 11,000-year history of Upper Bolton Lake, with only one major transition in the depositional environment. About 3.5 m below the surface, the mucky swamp deposits above transition to a less organic, clay-rich gyttja which indicates a

deeper depositional environment. Overall, this project contributes to research regarding Holocene environmental change and human impacts within the New England landscape while also informing the questions of local residents.

ACKNOWLEDGMENTS

I'd like to thank Dr. William Ouimet and Dr. Robert Thorson for their invaluable guidance in advising my research and thesis. A very special thanks goes to Samantha Dow, who was so generous with her time and knowledge throughout the entirety of this project. I'd like to thank field/lab aides Jillian Lenti, Cameron Mitchel, Kelly Flannery, and Ben Van Dine, who were nice enough to donate their time and help keep me sane. Thank you to Peter Van Dine and the Friends of Bolton Lakes for their stewardship of these great community resources and for bringing us in to investigate Upper Bolton Lake. Thanks to Debbie Surabian, Jacob Isleib, Donald Parizek of the USDA-NRCS for their contributions in the lab and the field; without them, this project would have only scratched the surface. Thank you to Lucas Proctor for help with wood identification. I'd like to thank the UConn Honors Program and the Center for Integrative Geosciences for providing countless opportunities to learn and grow during my four years here. I'm excited to see the program realize its full potential as the new Department of Geoscience.

TABLE OF CONTENTS

INTRODUCTION

The modern New England landscape is the result of centuries of heavy modification from European settlers. Anthropogenic forces seem to leave no aspect of nature untouched, and even places which today have an illusion of natural serenity, the signs of meddling remain. The New England landscape was nearly entirely stripped of its natural forests as settlers spread and took ownership of their landscape. River and lake systems were heavily disturbed by humans, sometimes incidentally and sometimes for industrial or recreational purposes. Longstanding beaver dams collapsed following the eradication of their stewards by hunters, while areas which never supported ponds or lakes were newly filled for any number of purposes.

Prior to human influence, it was Pleistocene glaciation that made massive geomorphic changes to New England's landscape. At the last glacial maximum, about 20,000 years ago, New England was covered with and shaped by the Laurentide Ice Sheet. Some lakes were created by the deposition of glacial material, which acted as a dam and built a reservoir. Depressions from glacial scouring also created many ponds and lakes in the time immediately following glacial retreat. In the immediate aftermath of glacial retreat, unvegetated (and thus, destabilized) deposits quickly mobilized and filled in shallower scours, while deeper depressions created ponds and lakes that lasted for hundreds or thousands of years. This is where the story of the modern Bolton Lakes began.

This paper investigates the history of Upper Bolton Lake from the early Holocene to the present, which in many ways, splits into two types of investigations. Lakes contain valuable sedimentary archives that can be used to interpret environmental change through time, which provides context for the deeper history of the lake. Subsurface sampling informs this paper on Holocene sediment deposition, which can be used to interpret some aspects of the environment. This is an investigation of how the landscape coped with the geomorphic changes which followed glacial retreat. A second investigation looks at the record of the site history post-European settlement. A review of historical documents, considered within the geologic context of the preceding thousands of years, is undertaken in this paper.

Upper Bolton Lake is drained by a culvert system underneath Hatch Hill Road to the south. State plans to modify this culvert system, perhaps beginning in the Fall of 2019, may affect future lake levels. The state modification plans can be viewed in Appendix A. Local concerns regarding the Atlantic White Cedar stand in the northeast portion of Upper Bolton Lake inspired this investigation of what the true "natural state" Upper Bolton Lake is, which can inform future decisions about its management.

BACKGROUND

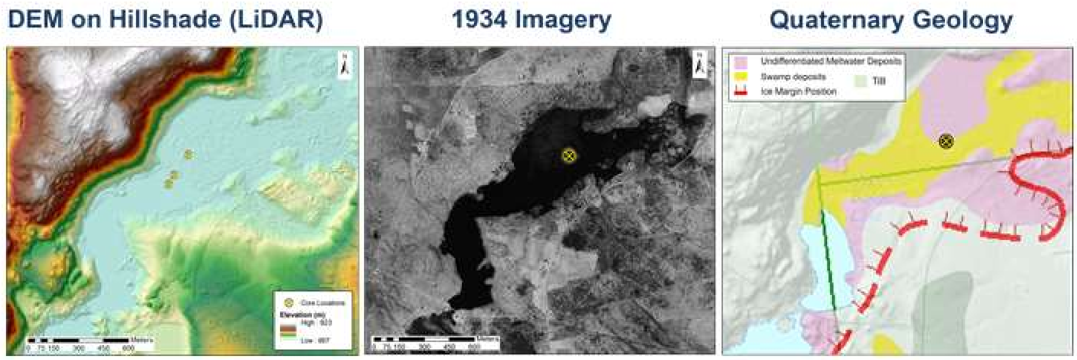
Atlantic White Cedar

A brief background on Atlantic White Cedar is important to contextualize this community resource and why people care about it. Atlantic White Cedar swamps are a unique habitat; they are considered to be one of Connecticut's "critical habitats" by CT ECO ("Connecticut Critical Habitats," 2011). The tree's picky characteristics make these cedar stands somewhat novel in Connecticut. Atlantic White Cedar is a "medium-sized tree" found along the east and south coasts of the United States. The species thrives in generally acidic peat deposits within freshwater swamps, as seen at Upper Bolton Lake. Atlantic White Cedar is not generally a target of any fungi or insects but is very susceptible to fire damage. Atlantic White Cedar is no longer an economically important wood but did see widespread use in the nineteenth and early twentieth centuries. In 1940, it was estimated that Atlantic White Cedar was produced at a rate of 300 million board feet per year (Schroeder & Taras, 1985). Annual production was estimated to be 19 million board feet in 1989 (Ward, 1989). Its lumber was prominently used in applications where its light weight and resistance to decay were of use, including for poles, shingles and other lumber.

Atlantic White Cedar habitats are generally not large, but they were widespread along the east coast before European settlement. Cedar wood was likely used by natives for purposes such as canoes. Once discovered by European settlers, AWC would be used for multiple purposes in which its unique characteristics were advantageous. Swedish botanist Pehr Kalm visited Philadelphia in 1748 recorded that “swamps and morasses formerly were full of them [AWC], but for the present, these trees are for the greatest part cut down and no attempt as yet has been made to plant new ones" (Morgan, 2006). AWC habitats have been harvested and shaped by humans for hundreds of years.

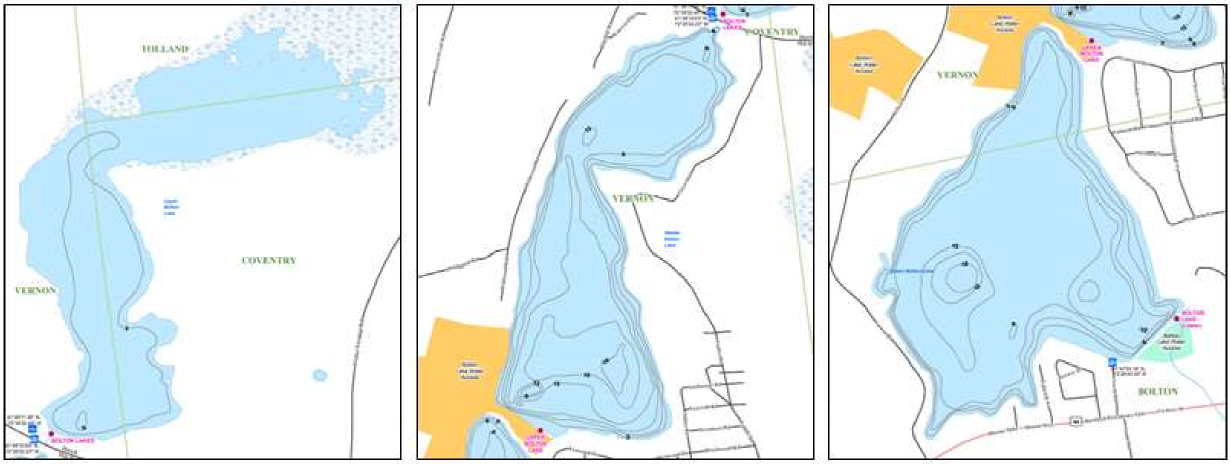
Site Background

Figure 1.



The Bolton Lakes are underlain by the Bronson Hill Anticlinorium, specifically the Monson Gneiss, the Middletown Formation (gneiss), and the Brimfield Schist. Three types of surficial deposits are mapped in the general area: glacial till, undifferentiated meltwater deposits, and organic-rich swamp mud. The Bolton Lakes appear to fill a glacial depression left behind after the retreat of the Laurentide ice sheet at the end of the last ice age. Upper Bolton Lake is the smallest and by far the shallowest of the three lakes.

Figure 2.



Upper Bolton Lake (UBL) | Middle Bolton Lake (MBL) | Lower Bolton Lake (LBL)

Bathymetric Maps of the three Bolton Lakes (CT DEEP). UBL is smaller and shallower than MBL and LBL.

The Bolton Lakes have a complicated recent history. There is a total of ten pre-Contact Native American archaeological sites within the boundaries of the Bolton Lakes. The lakes are not well studied, but surveys of similar wetlands have uncovered archaeological deposits dating back 10,000 years (Forrest & Clouette, 2008). While there was not a settlement at this site, it was likely commonly passed through by Native Americans. European settlement in the area began in 1673. In *The Settling of Bolton*, Samuel Alvord writes: "The oldest document on record relating to the transfer of land in Bolton is a grant by the General Court of Connecticut to Capt. Thomas Bull for services in the Indian Wars, bearing the date May 8, 1673. He received 200 acres near Cedar Swamp, which later was dammed to become Bolton Lake." Multiple documents confirm that this area was simply called "Cedar Swamp," implying that even if there were bodies of water here, the defining characteristic was a large stand of cedar trees.

Figure 3.

Nineteenth century maps of the Bolton Lakes. 1857 is the first to show Upper Bolton Lake.

Maps from 1811, 1845 and 1857 are shown in Figure 3. It is unknown when the Bolton Lakes were created, but we know that they first appear on the map in 1811 (scale 1:160,000). Lower and Middle Bolton Lakes are present on the map, connected by a distinct stream. They hardly resemble their modern counterparts and were more likely just small ponds rather than lakes. The identity of LBL and MBL on the map can be easily verified due to the Vernon-Bolton town boundary that runs in-between the two lakes. Our study location, Upper Bolton Lake, is not mapped at this time. Another map in 1845, albeit at a less detailed scale (1:480,000), also shows the other two lower lakes without mapping Upper Bolton Lake. The first to show Upper Bolton Lake in addition to the others was a map of Tolland county from 1857 (1:50,000). Sawmills are mapped in the area and may have harvested cedar from the stand. Upper Bolton Lake could be missing from 1811 and 1845 maps for two reasons. The first, and most obvious, is simply that the lake did not exist at the time that the maps were made. The second is that there was a map-making error. The results section discusses possible answers to the questions regarding Upper Bolton Lake’s time of origin and its mechanism.

METHODOLOGY

Field Work

Initial plans called for multiple cores to be collected at the lake, as well as within the tree stand, to gain an understanding of stratigraphy across a transect. A first attempt of push-coring within the stand in early November failed; core tubes would penetrate below the surface, but would not fill with recoverable material. This may be due to woody debris blocking the tube at the bottom. Vibracoring was attempted in early December. UBL-1 (93 cm) and UBL-2 (117 cm) were recovered using 20-ft core tubes. This was significantly less recovery than expected.

Photos 1, 2 and 3.

Attempted push-coring within the stand.

Vibracoring on the edge of the stand.

Examining cores in lab with the USDA-NRCS.

In early January, a final attempt to recover material was undertaken with the USDA-NRCS using a macaulay peat probe, shown in photos 4, 5 and 6. This differed from previous attempts, as the probe involves sampling in chosen sampling intervals, rather than the continuous sample seen in a core tube. UBL-3 (800 cm) and UBL-4 (705 cm) were recovered with this method. An attempt was made to recover samples from within the modern tree stand, but poor ice conditions meant it was not safe to do so.

Photos 4, 5 and 6.

Sampling with the macaulay probe through a hole in the ice.

Recording sample observations in the field.

Small sample of recovered material in lab.

Ground Penetrating Radar data was collected at the site following a straight-line transect between the sites of UBL-4 and UBL-3.

Lab Work

Loss-on-ignition analysis (LOI) was conducted on multiple samples along the full range of depths to characterize relative organic content throughout the subsurface, particularly above and below the transition point from mucky peat to gyttja. LOI oxidizes organic carbon and evaporates any water from the samples, leaving behind inorganic material (Pasternak).

This paper was meant to include XRF (X-Ray Fluorescence) to characterize metals concentrations throughout time. An equipment failure prevented full analysis within the timescale of this paper.

Radiocarbon dating was conducted by the National Ocean Sciences Accelerator Mass Spectrometry (NOSAMS) facility at Woods Hole Oceanographic Institute. One sample from UBL-4 and three samples from UBL-3 were characterized. These results are listed in Table 1 in results.

Vibracores (UBL-1 and UBL-2) were described immediately upon opening in-lab by the USDA-NRCS using standard OSD protocol.

Two fragments of sub-surface wood were analyzed by Lucas Proctor, a graduate student from the UConn Archaeobotany Laboratory. A carbonized fragment from a 210 cm depth in UBL-3 and an uncarbonized fragment from 280 cm in UBL-4 were analyzed. Samples were described along transverse, radial and tangential sections.

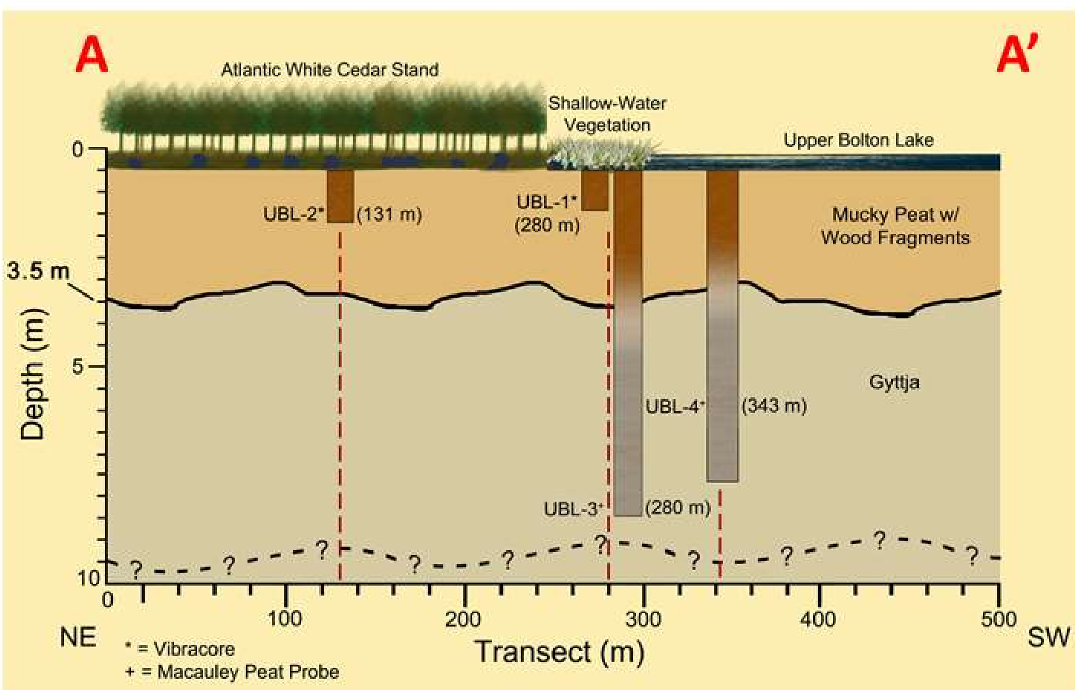
An extensive historical records review was conducted to gain insight on anthropogenic impacts on the local region. This included a review of historical images dating back to 1934; historical maps dating to 1811; historical society documents; historical newspaper articles (predominantly Hartford Courant); and of archaeological reports for sites near the Bolton Lakes. Background information and data from the Friends of Bolton Lakes (FBL) and the Bolton Lakes Watershed Conservation Alliance (BLWCA) was used for background review. Connecticut 2016 statewide topographic LiDAR hillshade data was used for this project.

RESULTS

Field Results

Vibracores and peat probe samples were described using standard OSD protocol. Datasheets including these characterizations are available in Appendix B. UBL-1 and UBL-2 provided continuous samples of the upper meter of their respective sampling sites and confirmed that the inner stand and the stand edge have similar recent history. UBL-3 and UBL-4 provided much more insight into deeper stratigraphy and deeper time, but without the benefit of being a continuous core record. "Cores" for UBL-3 and UBL-4 were reconstructed in photoshop and mapped along a transect shown in Figure 4. Figure 5 shows this transect in map view.

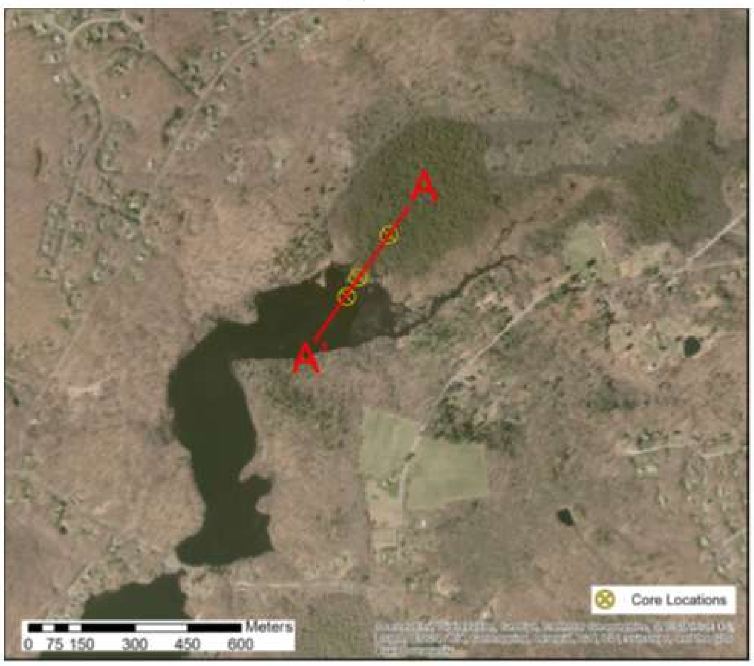
Figure 4.



Transect of sampling locations at UBL. UBL-2 is the only location truly within the tree stand. Note that UBL-1 and UBL-3 are in the same location.

A transition over time from deep lake gyttja to swamp-environment mucky peat is observed at roughly a 350 cm depth in these samples. This transition is gradual and subtle, indicating that this was not a quick or catastrophic change. The upper three meters of sample are invariably organic-rich. Wood fragments and charcoal fragments are visible in multiple areas of this upper layer. The color is generally characterized as a dark or dusky red. Below the gyttja transition, color changes to a grayish brown. Some trace mica is present. Material is sapric; organic content is present but unidentifiable.

Figure 5.

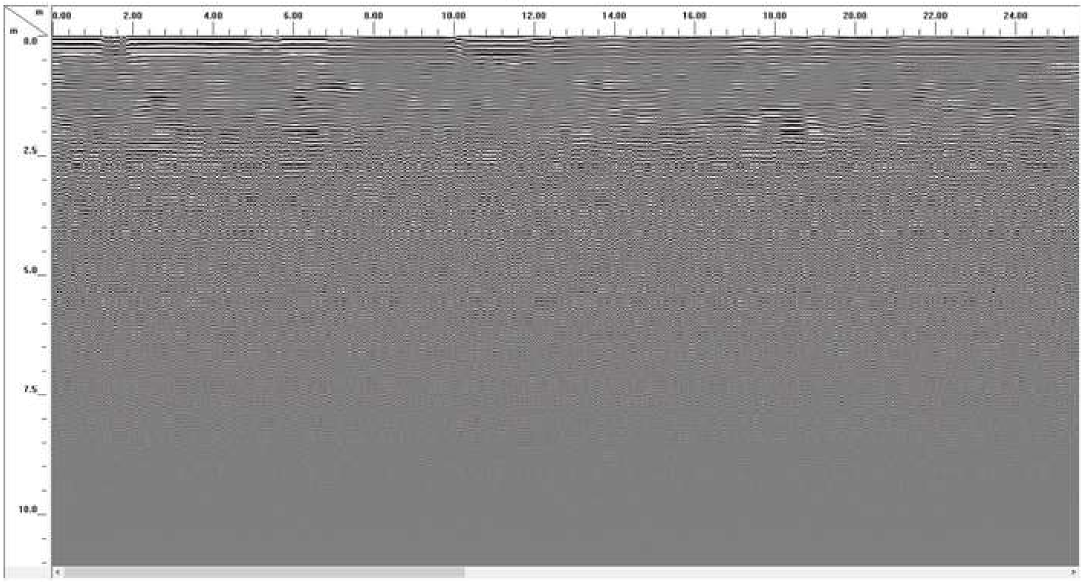


The transect in map view.

Ground Penetrating Radar

The GPR survey was conducted along the transect of sampling sites, but ice conditions would not allow surveying within the tree stand. The GPR results did not contradict sampling results. GPR did not locate the bottom of the gyttja layer, indicating that our sampling depth of 8 meters was not near the bedrock base of this depositional environment. The results of this survey are shown in Figure 6.

Figure 6.



GPR survey results, outside of tree stand, along transect.

Loss on Ignition

A stark difference between the modern mucky peat deposits and the older gyttja deposits is visible on the LOI chart in Figure 7 due to a relative decrease in organic content following the transition point.

Radiocarbon Dating

The carbon dates reveal that the modern cedar swamp habitat has existed at the site of Upper Bolton Lake for more than 3,000 years. The ages above and below the gyttja-muck transition reaffirm visual observations that the transition from deep lake to swamp was slow, perhaps lasting 150-300 years. This implies that there is no break in the depositional record during this transition. The deep lake preceding the modern swamp is dated to the early

Holocene, about 11,000 years ago, and GPR did not locate the bottom of the gyttja layer. These results do not rule out the possibility that this lake could have been a landscape feature immediately following glacial retreat. Radiocarbon dates are listed in Table 1.

Table 1.

Sample	Cal. Years BP*	Cal. Std. Dev.	Accession #**
	95% Prob Mean	95% Prob 1 Sigma	
UBL4-280	**3,319**	**40**	OS-147733
UBL3-345	**3,542**	**36**	OS-147730
UBL3-380	**3,776**	**39**	OS-147731
UBL3-800	**10,996**	**121**	OS-147732

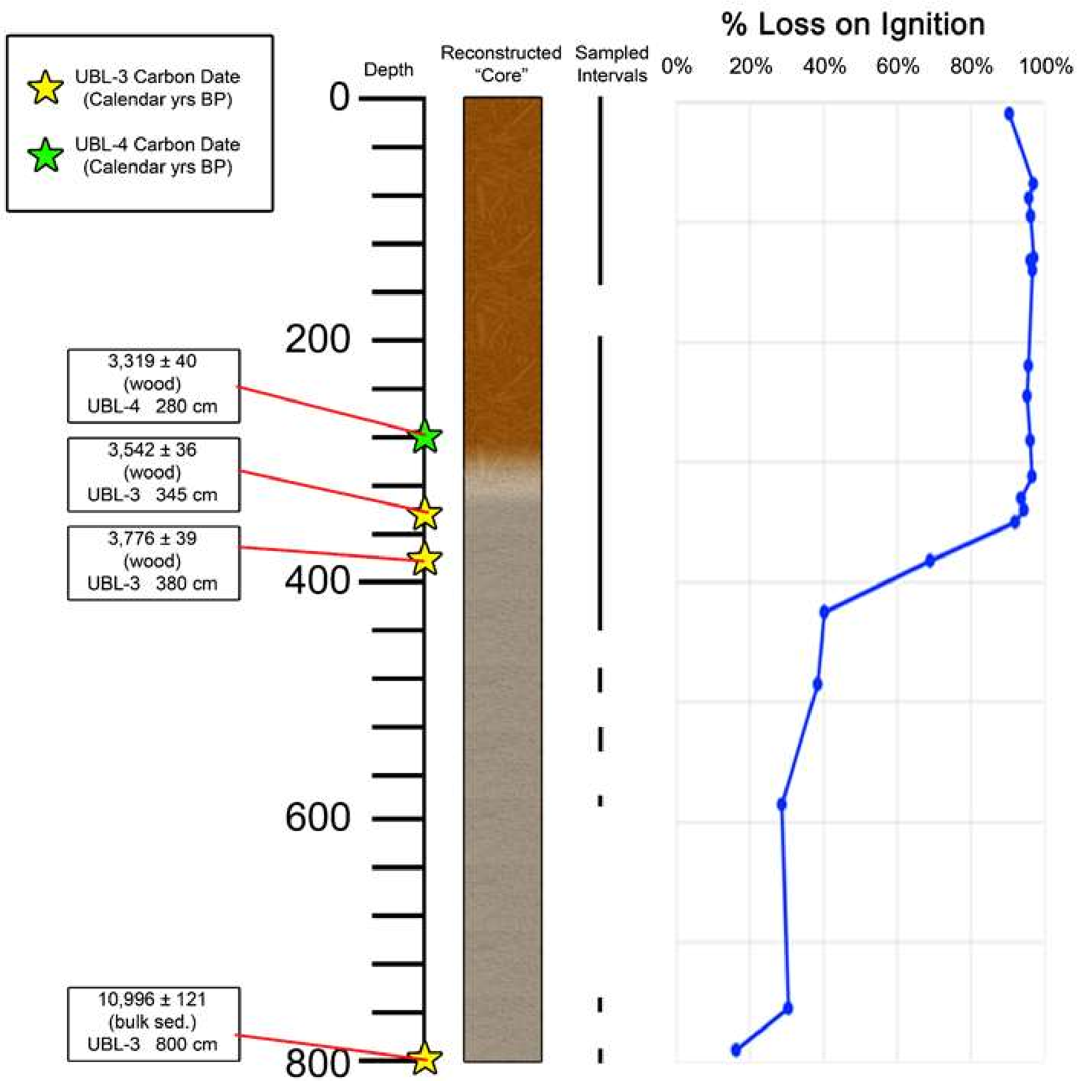
Carbon dates of selected samples above and below the transition between swamp deposits and clay-gyttja deposits.

*Calendar ages were calibrated using OxCal (https://c14.arch.ox.ac.uk/oxcal/OxCal.html) Atmopspheric Curve IntCal13 (Reimer et al, 2013)

**Acession number assigned for reference by lab. Radiocarbon dating was performed at the National Ocean Sciences AMS facility (NOSAMS) at Woods Hole Oceanographic Institute, which is supported by NSF Cooperative Agreement number OCE-1239667.

Figure 7 is a comprehensive review of the dates and LOI results mapped alongside the UBL-3 reconstruction. The figure also shows a visualization of the sampling density at different depths along the “core.”

Figure 7.

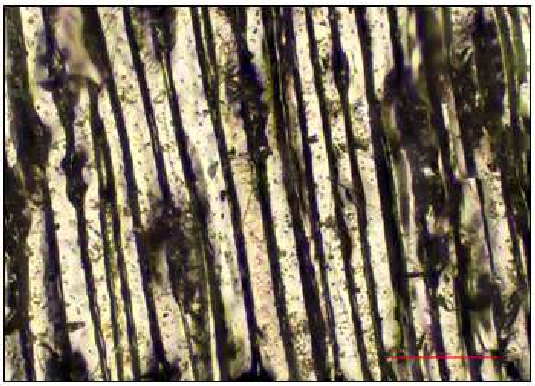


Comprehensive review of carbon dates, sampled intervals, and LOI alongside the UBL-3 "core" reconstruction.

Wood Identification

A wood fragment from 2.8 m below surface in UBL-4 was identified as cedar. It was not possible to draw a definitive conclusion in this analysis, but the fragment is very likely either Atlantic White Cedar or Northern White Cedar. These two tree species are anatomically similar at this scale and can be more diagnostically differentiated by looking at the tree's leaves and cones. A second wood fragment from 2.1 m below surface in UBL-3 was identified as eastern hemlock. Eastern hemlock commonly grows alongside Atlantic White Cedar (Schroeder et al., 1985).

Figure 8.

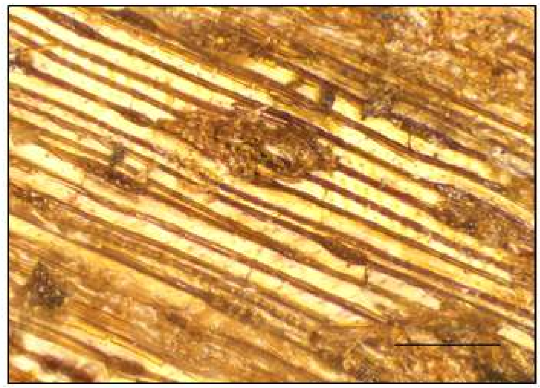


UBL3 – 210 cm

1 carbonized fragment

Identification:

Tsuga canadensis (Eastern Hemlock)



UBL4 – 280 cm

1 uncarbonized fragment

Identification:

Thuja occidentalis (Northern White Cedar) OR
Chamaecyparis thyoides (Atlantic White Cedar)

Microscope images of identified wood fragments.

Historical Review

Based on the historical maps uncovered, it is not unreasonable to posit that UBL was not present until the 1850s. Further research into historical records implies that this is actually likely. The Bolton Historical Society insinuates in multiple articles that there were no lakes on-site until the mid-1800s. In *Bolton's Mysterious Roving Islands*, town historian Hans DePold states: "Bolton Lake was created in the mid-1800s as part of a system to provide waterpower to the mills of Willimantic before electricity, internal combustion motors, or even steam power. The prehistoric Mohegan tool-making site at Bolton's Cedar Swamp was submerged when the lake was created."

Bolton Lake was a term coined in the nineteenth century to describe what we now call the three Bolton Lakes. This term, along with the name "Willimantic Reservoir" (due to its use by the Willimantic Linen Company) was used well into the twentieth century. The notion that "Bolton Lake" was created from nothing in the mid-1800s is clearly dispelled by the presence of some early version of MBL and LBL appearing in the 1811 and 1845 maps. The lakes may have become more robust, and UBL may have been created, following the 1854 acquisition of the Cedar Swamp area by the Willimantic Linen Company. The company purchased the site to create a reservoir that could regularly be filled and drained upstream of their mill, providing control over the water power that fueled their manufacturing. This control would be particularly valuable in the drier summer months.

The company owners would have had no fear of investing heavily in the site to modify it for their needs. A recounting of a similar reservoir project undertaken by the company in the 1860s provides insight on how they treated these projects. From Thomas Beardsley's *Willimantic Industry and Community*: "The Linen Company's postbellum motto was 'spend, spend, spend.' The new mill's capacity demanded increased water power, and Dunham and Ives had no hesitation in investing capital to build a large dam […] they employed 25 men and five teams of horses to build the 20-foot tall, 130-foot wide dam, which created Columbia Lake."

It is quite possible that the work of the linen company reshaped the lakes and created Upper Bolton Lake via the flooding of an existing cedar swamp. The company continued to use the reservoir for power for decades to come. A 1929 article in the Hartford Courant confirms that the lakes were still in use at that time- a record drought, combined with the company's draining of the lakes, left the area "practically exhausted," which forced summer tenants to leave their homes due to the lack of water ("Bolton Lake Reaches Record Low Level Due to Drought," 1929).

DISCUSSION AND CONCLUSIONS

The Transition: Gyttja to Mucky Peat

The transition from a deeper lake environment depositing gyttja to a shallower, swampier environment is documented at this site, but a mechanism for this change is not immediately evident. A review of Holocene temperature records in Oswald et al. and Shuman & Marsicek, 2016 indicates that the transition in depositional environment does not correlate with any major climatic shifts. Biological influence is unlikely; humans would not have created the dam that held this lake, and would not have been likely to destroy it. Beavers almost definitely could not have created and sustained this dam for so many thousands of years before a dam break. The most likely scenario in the view of this thesis is that this lake filled a post-glacial depression that was blocked by a moraine. The lake filled with sediment steadily and rather unremarkably for thousands of years, before eventually filling entirely. Once it shallowed enough, vegetation spread and began to create marsh conditions, and eventually, a cedar swamp.

The Story

Synthesis of project data into a cohesive timeline is a key aspect of the science communication aspect of this project. A “best guess” at the history of Upper Bolton Lake from the post-glacial age to the present informs local community members of geological principles in relation to their community’s natural assets.

The topographic low that the Bolton Lakes occupy is a glacially carved depression from the Pleistocene. Soon after the retreat of glaciers, a dam naturally formed and created a deep lake. This dam was likely a moraine deposit at the glacial ice margin during retreat. This lake existed for more than 7,000 years and continuously deposited what we have described as gyttja. Around 3,600 years before present, the deep lake system began to shallow and the habitat changed from lake to swamp. It eventually supported cedar.

The swamp remained largely unchanged for about 3,000 years until European settlers moved to the area and began harvesting the trees. Further modification occurred when residents artificially dammed the lakes for their own purposes. In the 1850s, the Willimantic Linen Company acquired the area and further impounded the lake system. The cedar stand to the north was flooded and became present-day Upper Bolton Lake. The stand shrank over the years daily and seasonal water level fluctuations for industrial use. When this use stopped, the modern cedar stand stabilized, to what we see today.

The stand of Atlantic white cedar in Upper Bolton lake has likely been a cedar stand for close to three thousand years. It is an increasingly unique habitat, which may be affected by upcoming state renovations to the Upper Bolton Lake culvert. State authorities and local interest groups should make every effort to preserve the state of this stand during and after the replacement of this culvert system.

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WPA Rebuilding Dam At Bolton Lake Resort. (1940, March 8). *The Hartford Courant*, p. 14.

APPENDICES

APPENDIX A: STATE CULVERT RENOVATION PLANS

STATE OF CONNECTICUT

QUI TRANSTULIT SUSTINET

DANNEL P. MALLOY, GOVERNOR

DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
WATER PLANNING AND MANAGEMENT DIVISION
ROBERT J. KLEE
COMMISSIONER

REPAIRS AND MODIFICATIONS TO UPPER BOLTON LAKE DAM

CT DAM ID# 14628

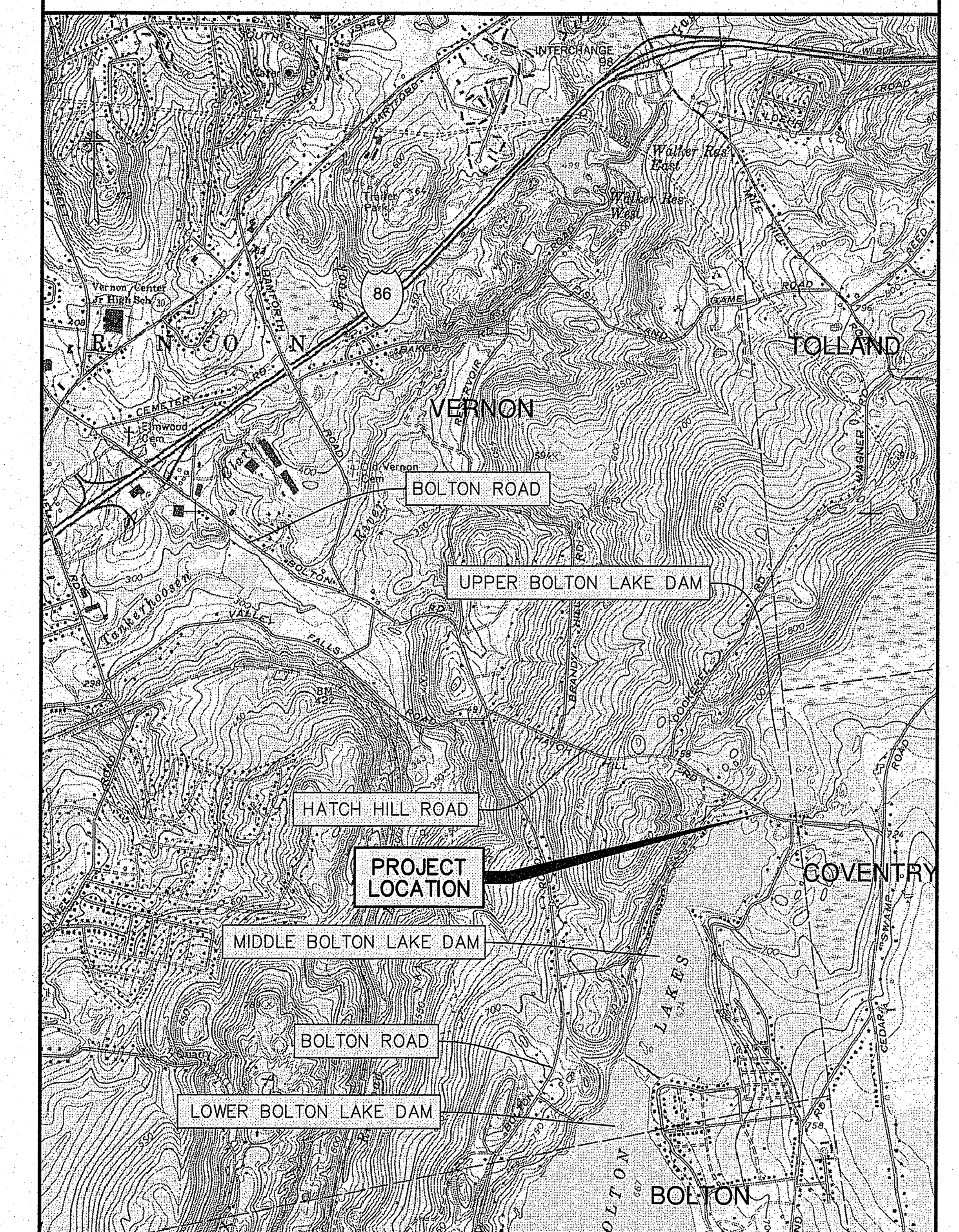
VERNON, CONNECTICUT

PROJECT NO. WR-DR-14628-2018-01

TATA & HOWARD
WATERBURY, CONNECTICUT

CONTRACT DRAWINGS

SHEET NO.	TITLE
1	SITE PLAN
2	SPILLWAY PLAN, SECTIONS AND DETAILS

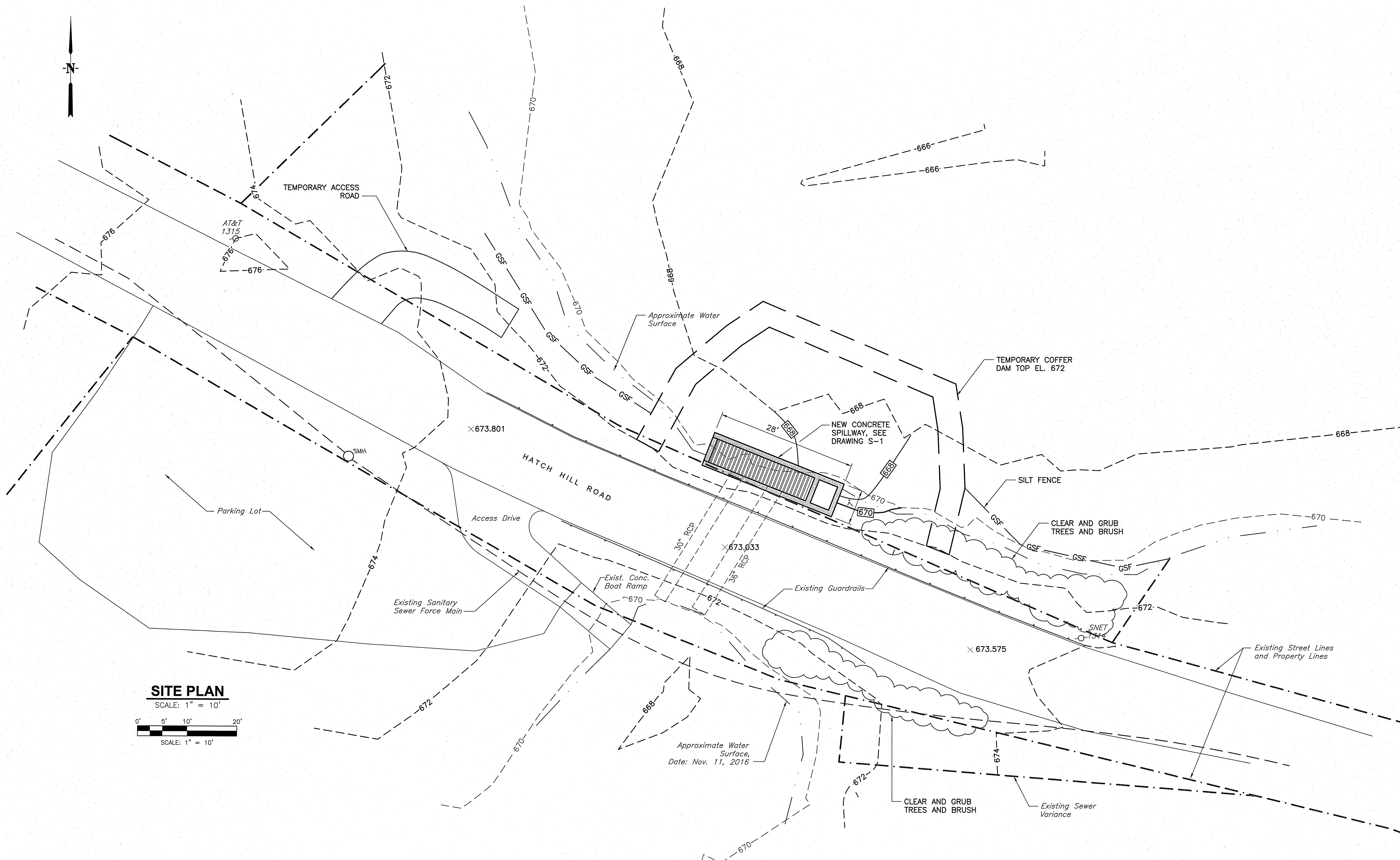


GENERAL LOCATION PLAN

4000 2000 0 2000 4000

APPROVALS

DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION DATE

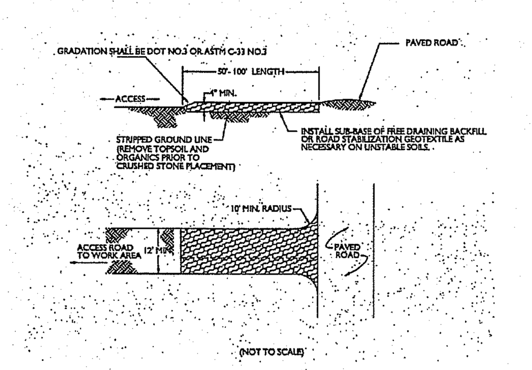


SITE PLAN

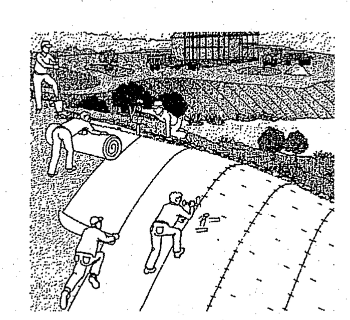
SCALE: 1" = 10'

0' 5' 10' 20'

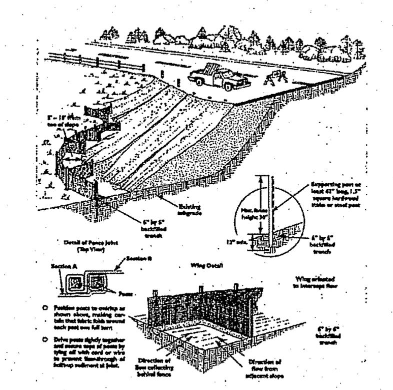
SCALE: 1" = 10'



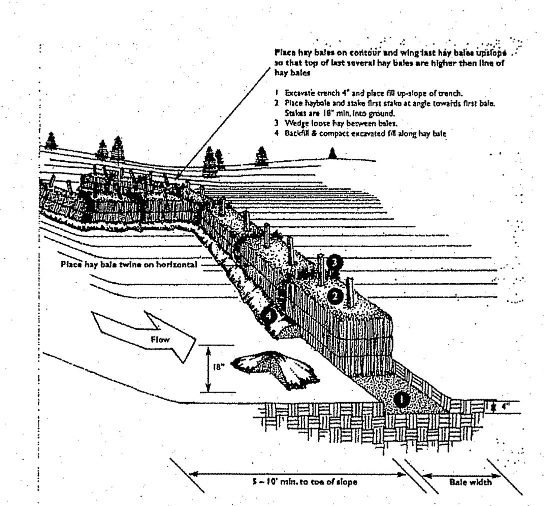
CE - DETAIL
FROM 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL



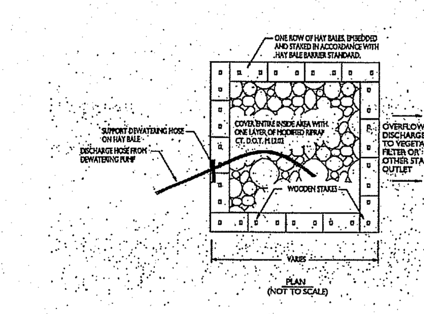
ECB - DETAIL
FROM 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL



GSF - DETAIL
FROM 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL



HB - DETAIL
FROM 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL



PSB - DETAIL
FROM 2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL

STATE OF CONNECTICUT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
REPAIRS AND MODIFICATIONS TO UPPER BOLTON LAKE DAM
VERNON, CONNECTICUT

Drawn By: DPB | Designed By: WSA | Checked By: | Approved By:

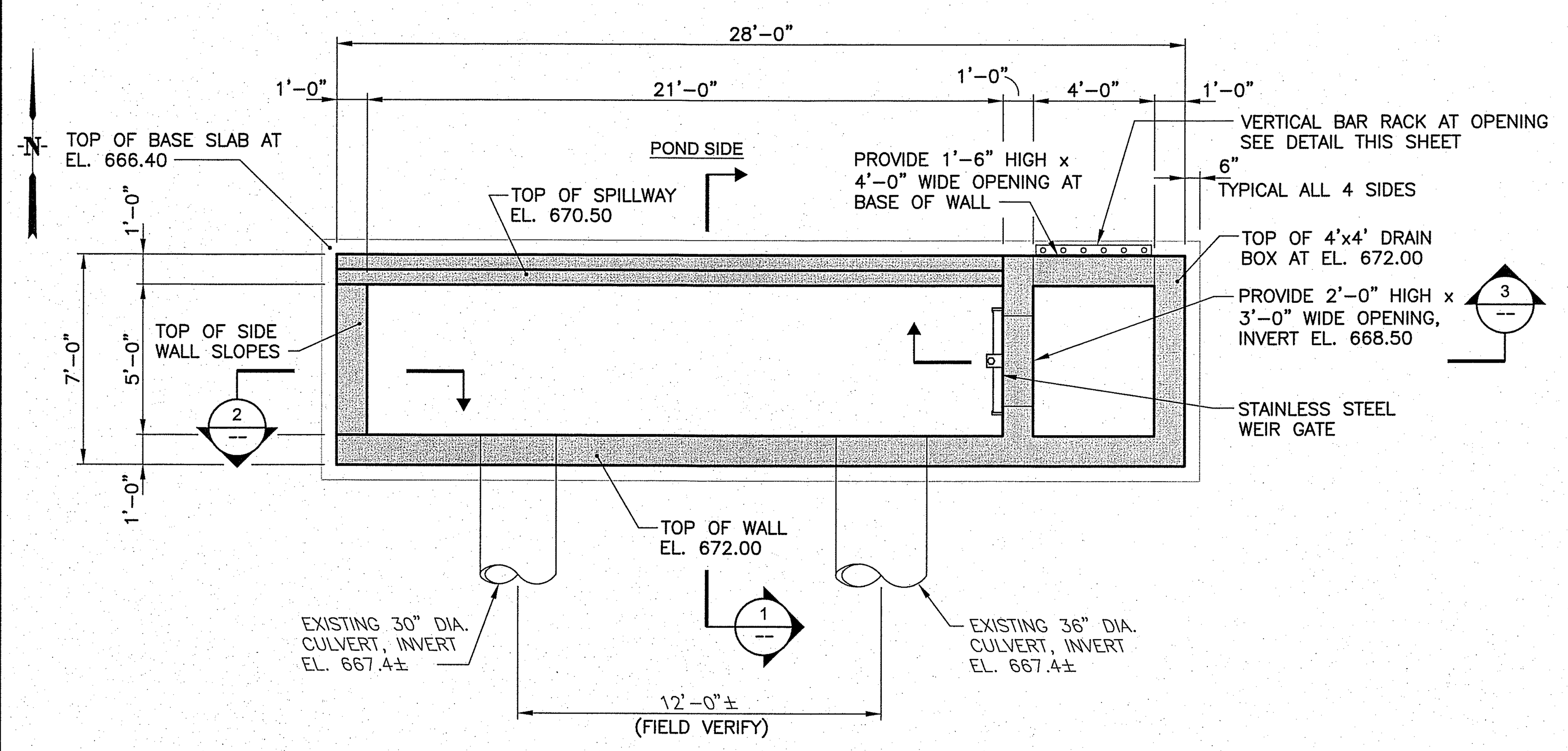
SITE PLAN

Rev.	Date	Description

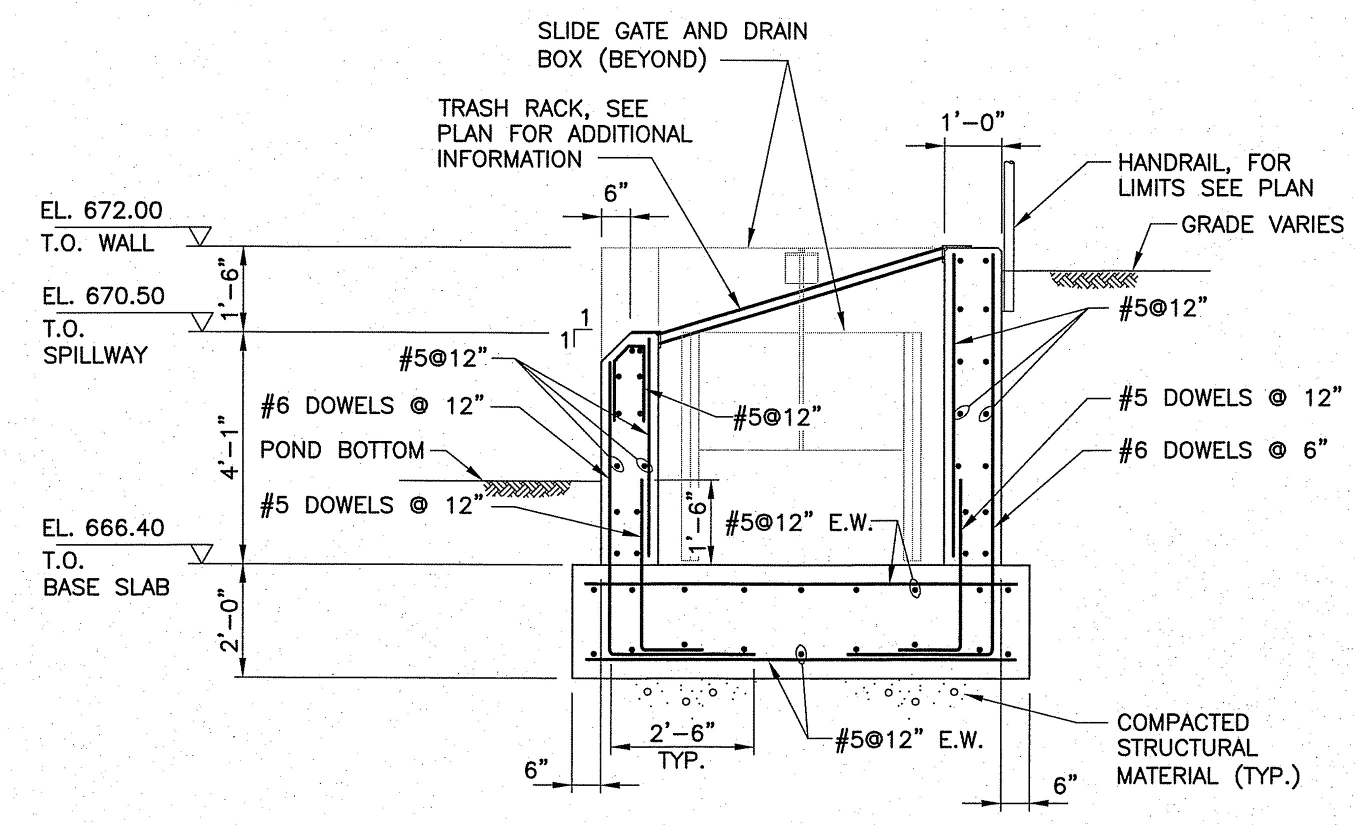
TATA & HOWARD

T&H NO.: 4876
DATE: FEBRUARY 2018
SCALE: AS NOTED

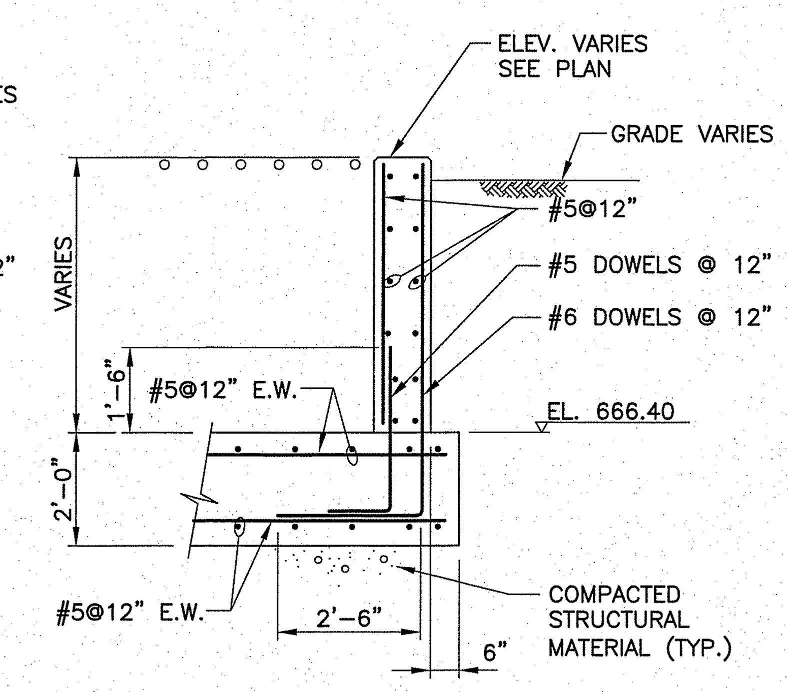
1



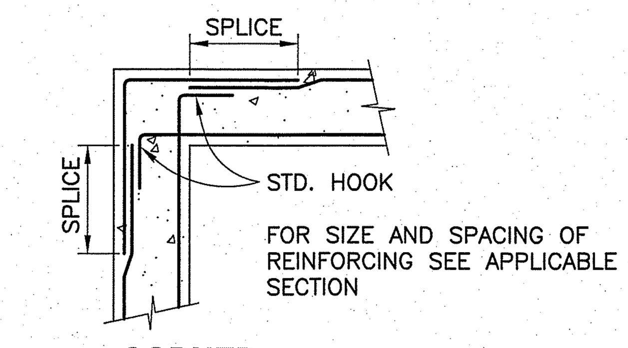
SPILLWAY PLAN
SCALE: 1/4" = 1'-0"



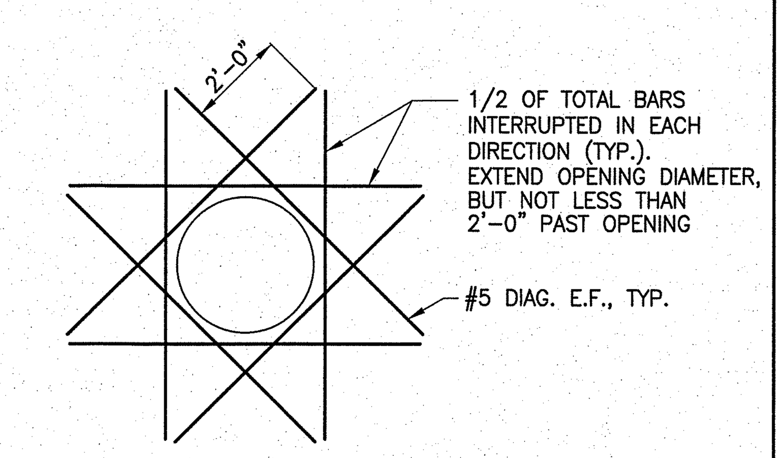
SECTION 1
SCALE: 3/8" = 1'-0"



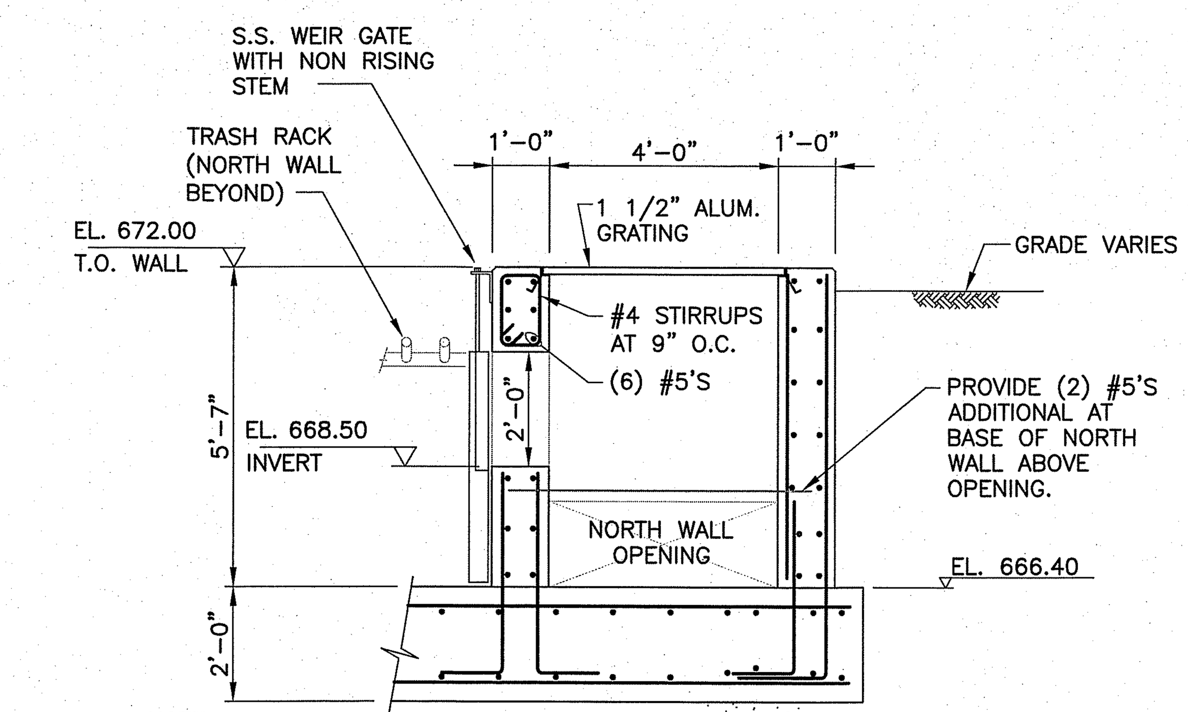
SECTION 2
SCALE: 3/8" = 1'-0"



WALL REINFORCING DETAILS
NOT TO SCALE
NOTE: VERTICAL REINFORCING NOT SHOWN.

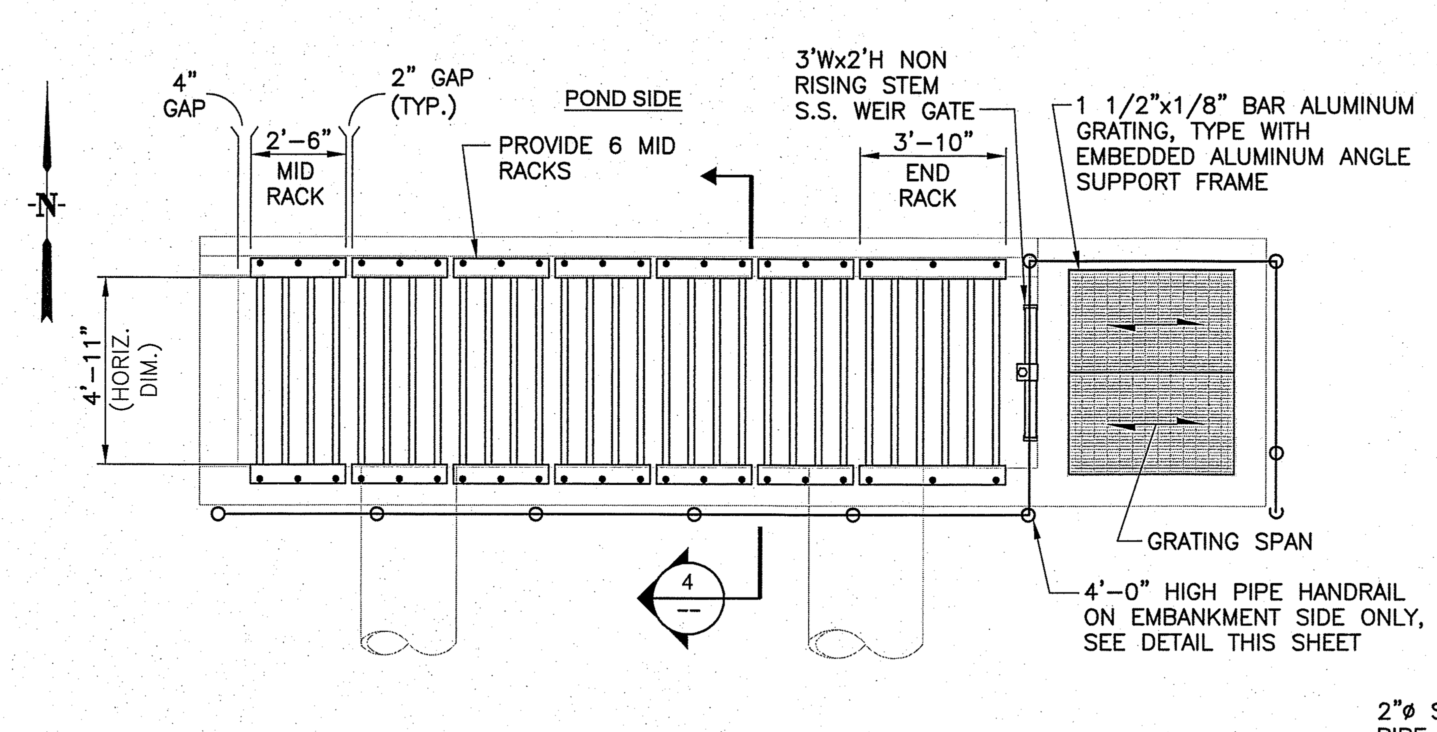


ADDITIONAL REINFORCING AROUND OPENINGS GREATER THAN 1'-0"
NOT TO SCALE
NOTE: BOTH FACES

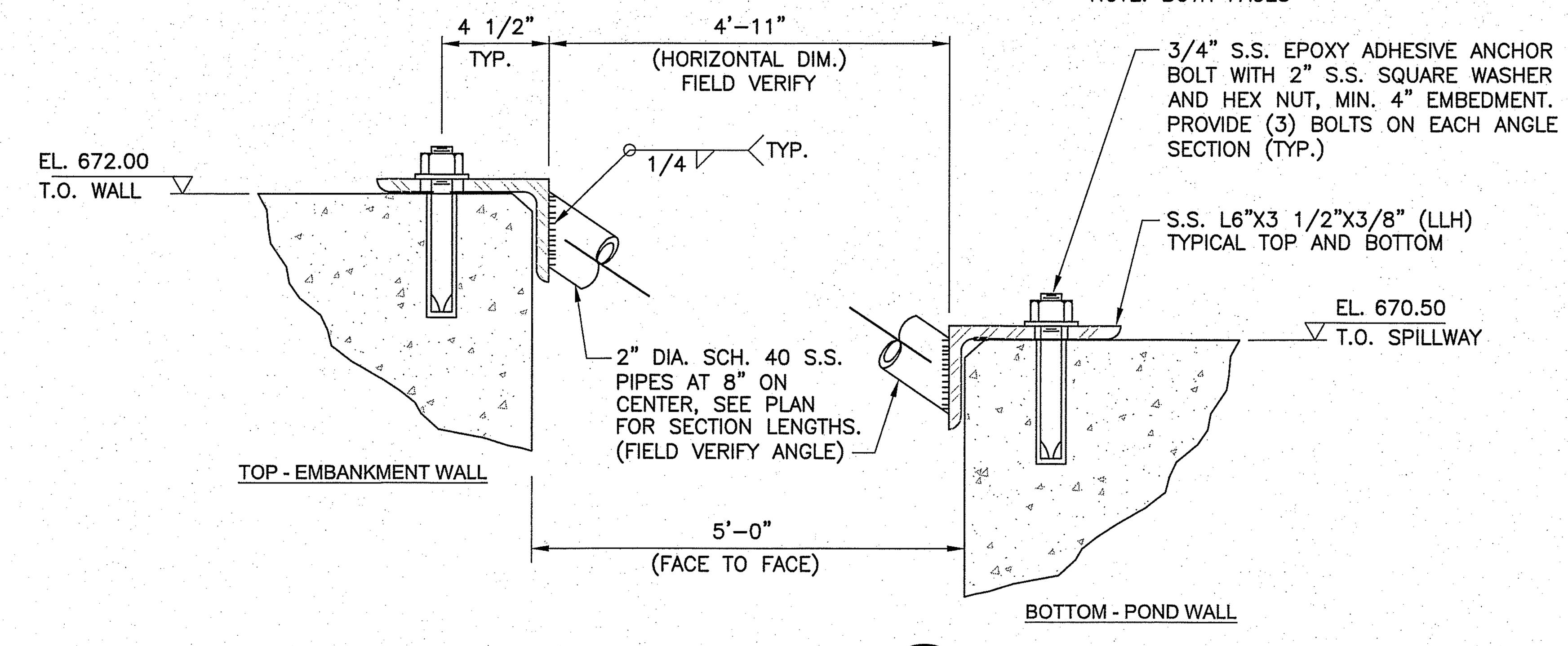


NOTE:
1. FOR WALL AND BASE SLAB REINFORCING INFORMATION NOT SHOWN SEE SECTIONS 1, 2 AND 3 THIS SHEET.
2. HANDRAIL NOT SHOWN FOR CLARITY

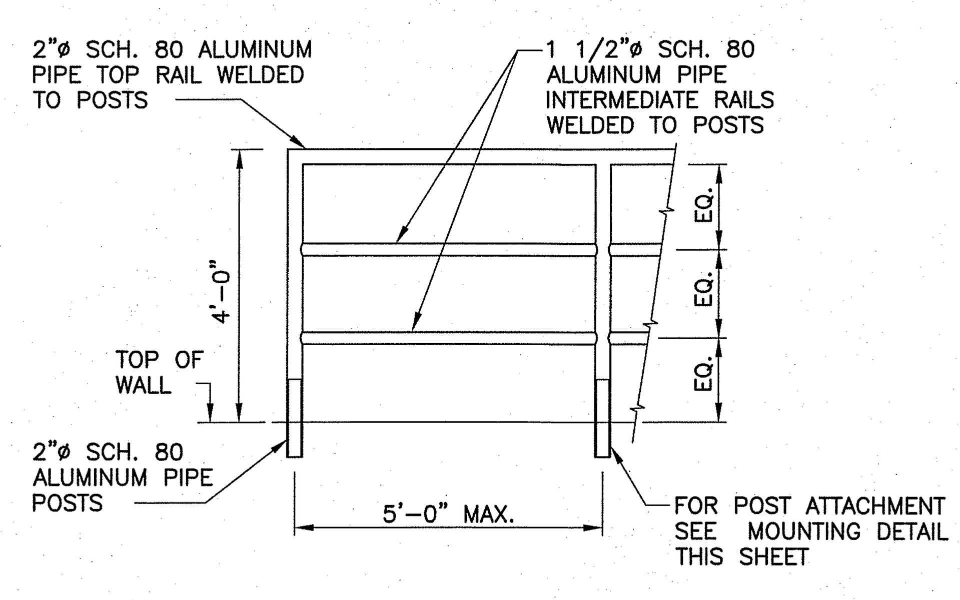
SECTION 3
SCALE: 3/8" = 1'-0"



SPILLWAY TRASH RACK
SCALE: 1/4" = 1'-0"



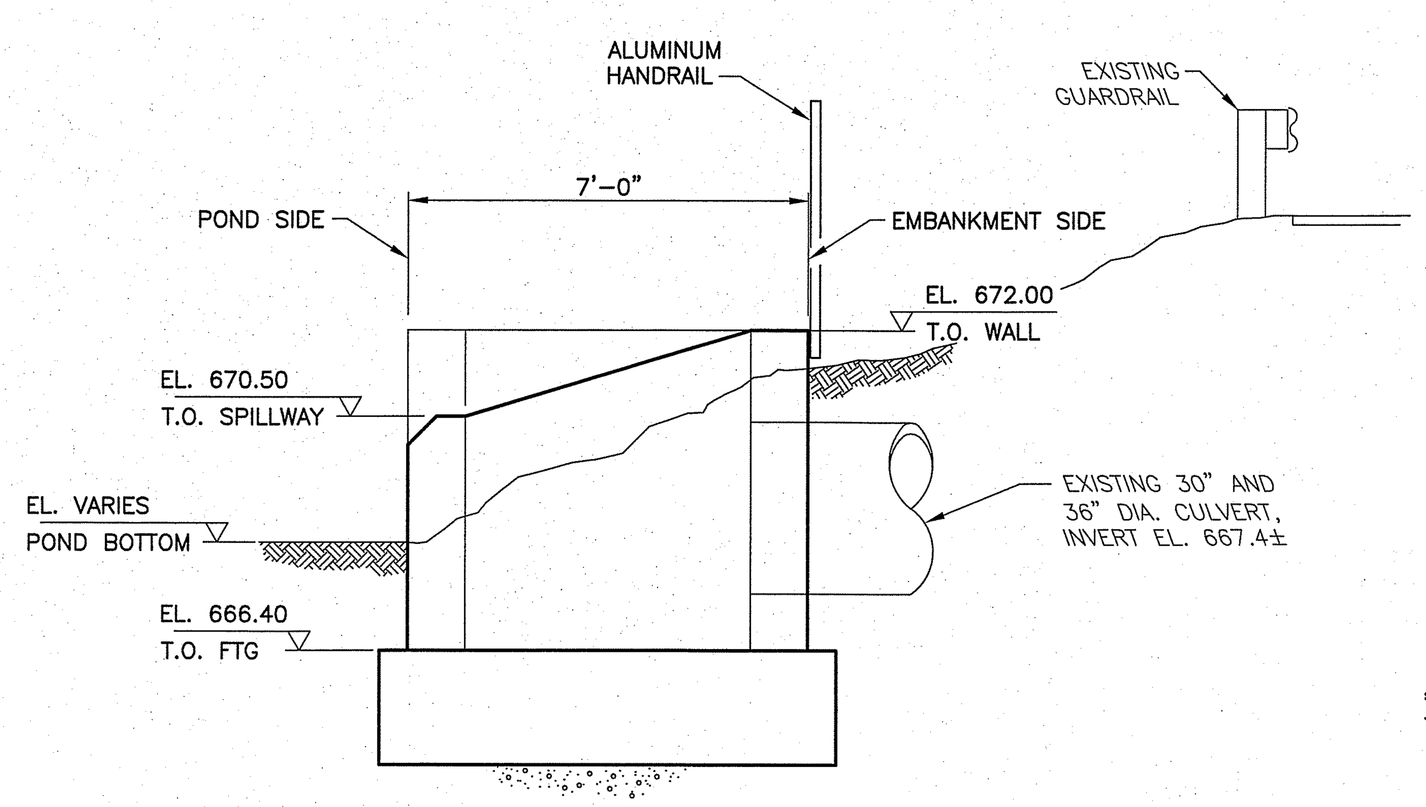
SECTION 4
SCALE: 3/8" = 1'-0"



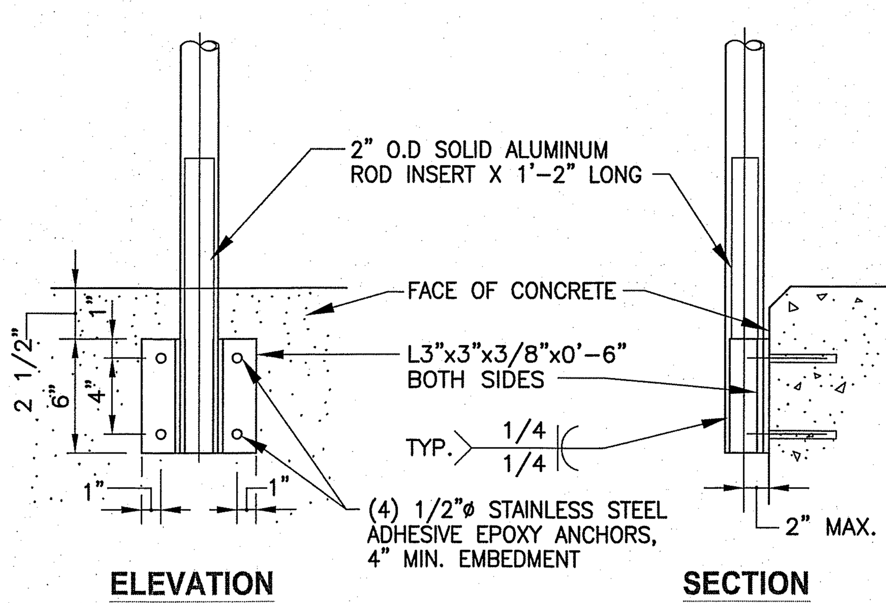
TYPICAL HANDRAIL DETAIL
NOT TO SCALE

REINFORCING BAR DEVELOPMENT PER ACI 318				
f'c = 4,000 psi				fy = 60,000 psi
BAR SIZE	BASIC TENSION DEVELOPMENT	TOP BAR DEVELOPMENT	COMPRESSION DEVELOPMENT	STANDARD HOOK DEVELOPMENT
# 5 (16)	2'-0"	2'-7"	1'-0"	1'-0"
# 6 (19)	2'-4"	3'-1"	1'-2"	1'-2"

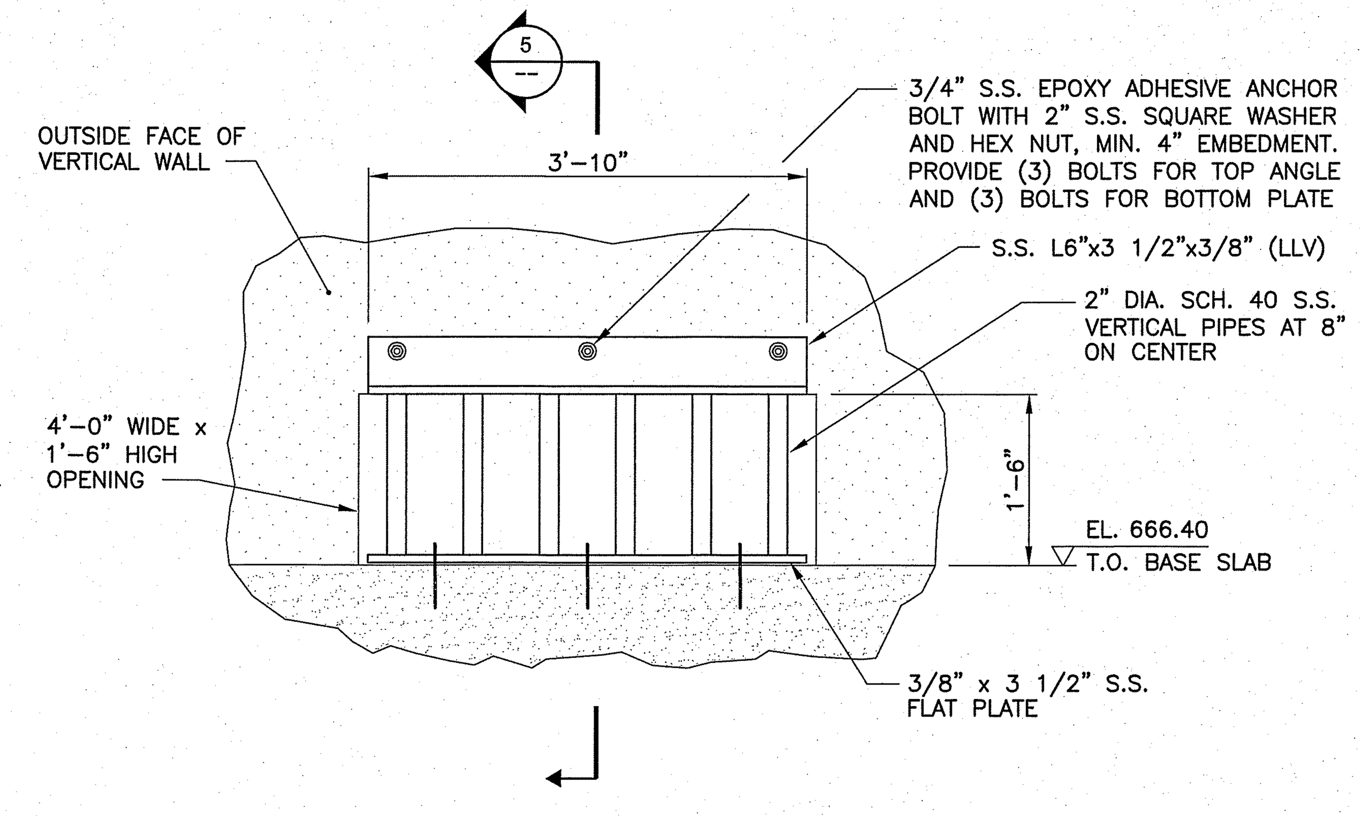
REINFORCING BAR SPLICES PER ACI 318			
f'c = 4,000 psi			fy = 60,000 psi
BAR SIZE	CLASS "B" SPLICE		COMPRESSION SPLICE
	TOP BARS	OTHER BARS	
# 5 (16)	3'-4"	2'-7"	1'-7"
# 6 (19)	4'-0"	3'-1"	1'-11"



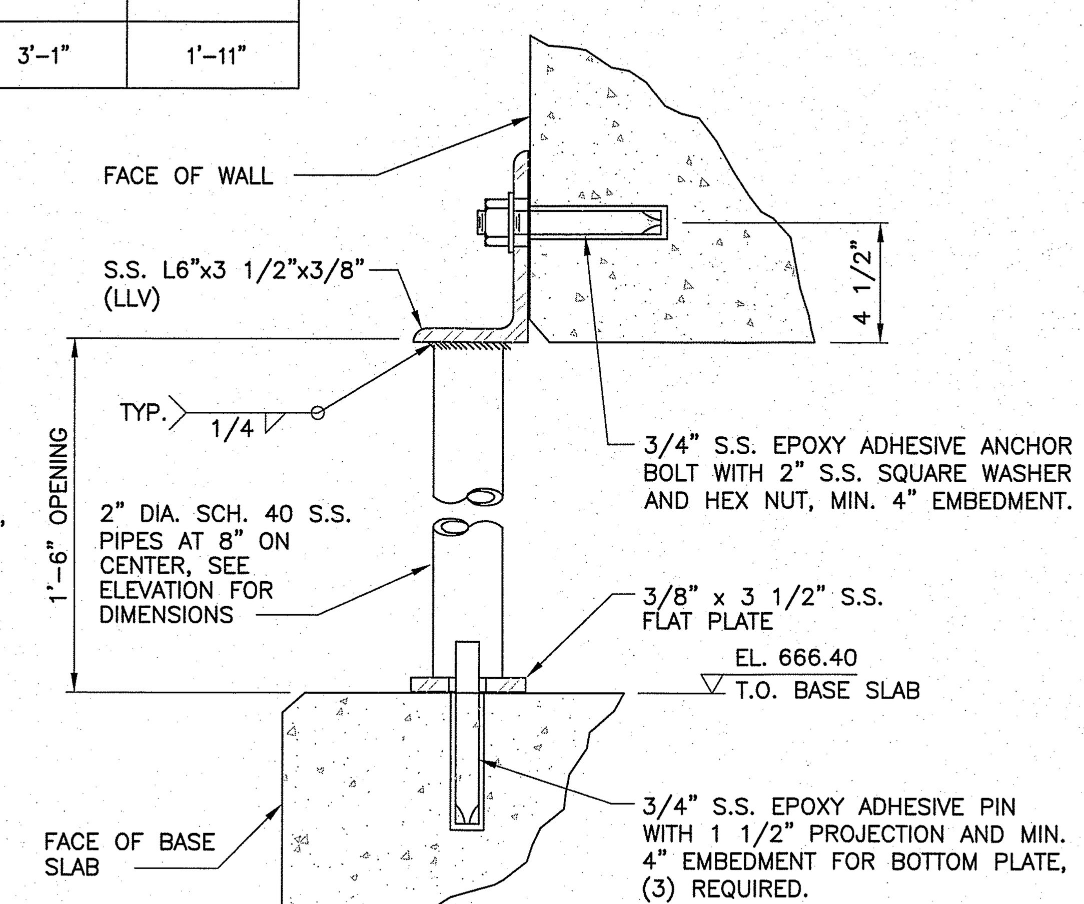
SPILLWAY - SIDE ELEVATION
SCALE: 3/8" = 1'-0"



HANDRAIL MOUNTING DETAIL
NOT TO SCALE



VERTICAL BAR RACK - WALL ELEVATION
SCALE: 1/4" = 1'-0"



SECTION 5
SCALE: 3/8" = 1'-0"

STATE OF CONNECTICUT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
REPAIRS AND MODIFICATIONS TO UPPER BOLTON LAKE DAM
VERNON, CONNECTICUT

Drawn By: DPB | Designed By: WSA | Checked By: | Approved By:

SPILLWAY PLAN, SECTIONS, AND DETAILS

Rev. | Date | Description

TATA & HOWARD

T&H NO.: 4876
DATE: FEBRUARY 2018
SCALE: AS NOTED

2

APPENDIX B: NRCS SOIL DESCRIPTIONS

IDENTIFIERS

UBL-1

Current Taxon Name (Soil Name): Catden

- OSD
- Series Extent
- Associated Components

User Site ID: 2019CT013001

User Pedon ID: 2019CT013001

Vegetation Plot ID: 2019CT013001

Lab Information:

- **Certified Lab Pedon Description -** no

Print Date: 2/25/2019

LOCATION

Location in Google Maps

Location in SoilWeb

Std. Latitude: 41.8269000

Std. Longitude: -72.4163900

Datum: WGS84

Location Description: Upper Bolton Lake, edge of tree stand and lake

Map Unit: 17—Timakwa and Natchaug soils, 0 to 2 percent slopes

Country: US—United States

State: Connecticut

County: CT013—Tolland

MLRA: 144A—New England and Eastern New York Upland, Southern Part

Regional Office: 12—Amherst, MA

MLRA Soil Survey Area: 12-TOL—Tolland, Connecticut

Non-MLRA Soil Survey Area: CT600—State of Connecticut

PEDON

Describers Name: Jacob Isleib, Debbie Surabian

Current Taxonomic Class: Euic, mesic Typic Haplosaprists

Current Taxon Kind: series

Pedon Type: undefined observation

Pedon Purpose: research site

Pedon Record Orgin: NASIS

Sampled As Information:

- **Soil Name -** Catden
- **Taxonomic Class -** Euic, mesic Typic Haplosaprists
- **Taxon Kind -** series
- **PSC -** 0 to 130 cm.
- **Classificaton Date -** 2/12/2019

SITE

Parent Material: herbaceous organic material over woody organic material

Drainage Class: very poorly

Surface Fragments:

Benchmark Soil?: no

VEGETATION

SITE OBSERVATION

Observation Date: 1/16/2019 (actual site observation date)

Surface Cover Properties:

- **Pedoderm Loose Cover Indicator -** no

Drained? - no

Bedded Soil? - no

Forest Plantation? - no

Classifier - Jacob Isleib

Soil Taxonomic Edition - twelfth edition

Moisture Class - peraquic

Moisture SUBClass - typic

Dynamic Soil Properties:

Pedoderm Loose Cover Indicator - no

Hydric: no

Pedon Horizon Lab Results - 1

Horizon	Top Depth	Bottom Depth	Sample ID	Data Collector	Total Clay	CaCO3 Clay	Total Silt	Fine Silt	Co. Silt	Total Sand	Total Sand Method	VC Sand	Co. Sand	Med. Sand	Fine Sand	VF Sand	VF Sand Method	Texture Class - Field Lab	Rubbed Fiber	Unrubbed Fiber	pH H2O
	cm	*cm*			*%*	*%*	*%*	*%*	*%*	*%*		*%*	*%*	*%*	*%*	*%*			*%*	*%*	
Oi	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	45	65	—
Oa1	—	34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	45	—
Oa2	—	63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	40	—
Oa3	—	93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	25	—

Pedon Horizon Lab Results - 2

Horizon	Top Depth	Bottom Depth	Sample ID	pH CaCl2	pH NaF	pH Ox	Delta pH	LL	PL	PI	Atter. Samp. Cond.	COLE	Pot. Acidity	Ca + Mg - Meh 2	K	Ca + Mg - Sat. Paste	KCl Extract. Acidity	Base Sat. - Meh 2	CEC-7	CEC-8.2
	cm	*cm*						*%*	*%*	*%*		*cm/cm*	*meq/100g*	*cmol(+)/kg*	*cmol(+)/kg*	*mmol(+)/l*	*cmol(+)/kg*	*%*	*cmol(+)/kg*	*cmol(+)/kg*
Oi	8	9	—	4.6	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa1	30	34	—	4.6	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa2	59	63	—	4.6	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa3	85	93	—	4.8	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—

Pedon Horizon Lab Results - 3

Horizon	Top Depth	Bottom Depth	Sample ID	ECEC	Phosphate P	NO3- N	EC	EC Method	EC 1:5 by volume	CaCO3 Equiv.	Equiv. Gypsum	Na	SAR	Gypsum Req.	Humic Color	Fulvic Color	Humic + Fulvic Color	Al	PI	Pyro. Hue	PyrO. Value	Pyro. Chroma
	cm	*cm*		*cmol(+)/kg*	*mg/kg*	*mg/kg*	*dS/m*		*dS/m*	*%*	*%*	*mmol(+)/l*	*%*	*L-pcu/g*	*L-pcu/g*	*L-pcu/g*	*%*					
Oi	8	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa1	30	34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa2	59	63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa3	85	93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Vegetation Plot Plants

Plant Symbol	Scientific Name	National Vernacular Name	Plant Type Group	Canopy Cover %	Vegetation Stata Level
UTPU	Utricularia purpurea	eastern purple bladderwort	—	—	—

Pedon Diagnostic Features

Feature Kind	Feature Depth L-H	Feature Thickness L-RV-H
	cm	
fibric soil materials	0—9	—9—
aquic conditions	0—93	—93—
sapric soil materials	9—93	—84—

Setting and Climate

Slope	Slope Length USLE	Upslope Length	Elev.	Corr. Elev	Aspect	MAP	REAP	FFD	MAAT	MSAT	MWAT	MAST	MSST	MWST	MFFP	PE Index	Climate Station ID	Climate Station Name	Climate Station Type
%	*m*				*degrees*	*mm*	*mm*		*C*						*mm*				
0	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—

Oi—0 to 9 centimeters (0.0 to 3.5 inches); dark brown (7.5YR 3/4) broken face peat; nonfluid; many very fine roots and many fine roots; abrupt boundary.; wet when described; observed in vibracore tube. organic "rotting" odor

Oa1—9 to 54 centimeters (3.5 to 21.3 inches); black (7.5YR 2.5/1) broken face muck; slightly fluid; 5 percent by volume nonflat angular noncemented 20-40-60 millimeter wood observed by visual inspection; abrupt boundary.; wet when described; observed in vibracore tube. organic "rotting" odor

Oa2—54 to 74 centimeters (21.3 to 29.1 inches); very dusky red (2.5YR 2.5/2) reduced and black (5YR 2.5/1) broken face woody muck; moderately fluid; 2 percent by volume nonflat subangular noncemented 2-5-10 millimeter charcoal observed by visual inspection and 15 percent by volume nonflat angular noncemented 10-20-30 millimeter wood observed by visual inspection; clear boundary.; wet when described; observed in vibracore tube. organic "rotting" odor

Oa3—74 to 93 centimeters (29.1 to 36.6 inches); black (5YR 2.5/1) broken face and very dusky red (2.5YR 2.5/2) reduced muck; very fluid; 5 percent by volume nonflat angular noncemented 10-20-20 millimeter wood observed by visual inspection.; wet when described; observed in vibracore tube. organic "rotting" odor

IDENTIFIERS

UBL-2

Current Taxon Name (Soil Name): Catden

OSD

Series Extent

Associated Components

User Site ID: 2019CT013002

User Pedon ID: 2019CT013002

Vegetation Plot ID: 2019CT013002

Lab Information:

Certified Lab Pedon Description - no

Print Date: 2/25/2019

LOCATION

Location in Google Maps

Location in SoilWeb

Std. Latitude: 41.8279600

Std. Longitude: -72.4153200

Datum: WGS84

Location Description: Upper Bolton Lake, Atlantic White Cedar swamp interior

Map Unit: 17—Timakwa and Natchaug soils, 0 to 2 percent slopes

Country: US—United States

State: Connecticut

County: CT013—Tolland

MLRA: 144A—New England and Eastern New York Upland, Southern Part

Regional Office: 12—Amherst, MA

MLRA Soil Survey Area: 12-TOL—Tolland, Connecticut

Non-MLRA Soil Survey Area: CT600—State of Connecticut

PEDON

Describers Name: Jacob Isleib, Debbie Surabian

Current Taxonomic Class: Euic, mesic Typic Haplosaprists

Current Taxon Kind: series

Pedon Type: undefined observation

Pedon Purpose: research site

Pedon Record Orgin: NASIS

Sampled As Information:

Soil Name - Catden

Taxonomic Class - Euic, mesic Typic Haplosaprists

Taxon Kind - series

PSC - 0 to 130 cm.

Classificaton Date - 2/12/2019

SITE

Parent Material: woody organic material

Drainage Class: very poorly

Surface Fragments:

Benchmark Soil?: no

VEGETATION

SITE OBSERVATION

Observation Date: 1/16/2019 (actual site observation date)

Surface Cover Properties:

Pedoderm Loose Cover Indicator - no

Drained? - no

Bedded Soil? - no

Forest Plantation? - no

Classifier - Jacob Isleib

Soil Taxonomic Edition - twelfth edition

Moisture Class - peraquic

Moisture SUBClass - typic

Dynamic Soil Properties:

Pedoderm Loose Cover Indicator - no

Hydric: no

Pedon Horizon Lab Results - 1

Horizon	Top Depth	Bottom Depth	Sample ID	Data Collector	Total Clay	CaCO3 Clay	Total Silt	Fine Silt	Co. Silt	Total Sand	Total Sand Method	VC Sand	Co. Sand	Med. Sand	Fine Sand	VF Sand	VF Sand Method	Texture Class - Field Lab	Rubbed Fiber	Unrubbed Fiber	pH H2O
	cm	*cm*			*%*	*%*	*%*	*%*	*%*	*%*		*%*	*%*	*%*	*%*	*%*			*%*	*%*	
Oe	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	45	—
Oa1	—	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	30	—
Oa2	—	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	5	—
Oa3	—	84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12	20	—
Oa4	—	111	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	15	—

Pedon Horizon Lab Results - 2

Horizon	Top Depth	Bottom Depth	Sample ID	pH CaCl2	pH NaF	pH Ox	Delta pH	LL	PL	PI	Atter. Samp. Cond.	COLE	Pot. Acidity	Ca + Mg - Meh 2	K	Ca + Mg - Sat. Paste	KCl Extract. Acidity	Base Sat. - Meh 2	CEC-7	CEC-8.2
	cm	*cm*						*%*	*%*	*%*		*cm/cm*	*meq/100g*	*cmol(+)/kg*	*cmol(+)/kg*	*mmol(+)/l*	*cmol(+)/kg*	*%*	*cmol(+)/kg*	*cmol(+)/kg*
Oe	0	5	—	4.7	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa1	7	13	—	4.4	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa2	36	41	—	4.5	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa3	78	84	—	4.4	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa4	105	111	—	4.7	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—

Pedon Horizon Lab Results - 3

Horizon	Top Depth	Bottom Depth	Sample ID	ECEC	Phosphate P	NO3-N	EC	EC Method	EC 1:5 by volume	CaCO3 Equiv.	Equiv. Gypsum	Na	SAR	Gypsum Req.	Humic Color	Fulvic Color	Humic + Fulvic Color	Al	PI	Pyro. Hue	PyrO. Value	Pyro. Chroma
	cm	*cm*		*cmol(+)/kg*	*mg/kg*	*mg/kg*	*dS/m*		*dS/m*	*%*	*%*	*mmol(+)/l*	*%*	*L-pcu/g*	*L-pcu/g*	*L-pcu/g*	*%*					

Pedon Horizon Lab Results - 3

Horizon	Top Depth	Bottom Depth	Sample ID	ECEC	Phosphate P	NO3-N	EC	EC Method	EC 1:5 by volume	CaCO3 Equiv.	Equiv. Gypsum	Na	SAR	Gypsum Req.	Humic Color	Fulvic Color	Humic + Fulvic Color	Al	PI	Pyro. Hue	PyrO. Value	Pyro. Chroma
	cm	*cm*		*cmol(+)/kg*	*mg/kg*	*mg/kg*	*dS/m*		*dS/m*	*%*	*%*	*mmol(+)/l*	*%*	*L-pcu/g*	*L-pcu/g*	*L-pcu/g*	*%*					
Oe	0	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa1	7	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa2	36	41	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa3	78	84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa4	105	111	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Vegetation Plot Plants

Plant Symbol	Scientific Name	National Vernacular Name	Plant Type Group	Canopy Cover %	Vegetation Stata Level
CHTH2	Chamaecyparis thyoides	Atlantic white cedar	—	—	—

Pedon Diagnostic Features

Feature Kind	Feature Depth L-H	Feature Thickness L-RV-H
	cm	
hemic soil materials	0—5	—5—
aquic conditions	0—117	—-
sapric soil materials	5—117	—112—

Setting and Climate

Slope	Slope Length USLE	Upslope Length	Elev.	Corr. Elev	Aspect	MAP	REAP	FFD	MAAT	MSAT	MWAT	MAST	MSST	MWST	MFFP	PE Index	Climate Station ID	Climate Station Name	Climate Station Type
%	*m*				*degrees*	*mm*	*mm*		*C*						*mm*				
0	—	—	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—

Oe—0 to 5 centimeters (0.0 to 2.0 inches); black (7.5YR 2.5/1) broken face mucky peat; nonfluid; few very fine roots and few fine roots; clear boundary.; observed in vibracore tube. organic "rotting" odor

Oa1—5 to 19 centimeters (2.0 to 7.5 inches); black (5YR 2.5/1) broken face muck; moderately fluid; few very fine roots and few fine roots; 2 percent by volume nonflat angular noncemented 10-20-30 millimeter wood observed by visual inspection; clear boundary.; observed in vibracore tube. organic "rotting" odor

Oa2—19 to 60 centimeters (7.5 to 23.6 inches); dark reddish brown (5YR 2.5/2) broken face muck; very fluid; 5 percent by volume nonflat angular noncemented 20-30-40 millimeter wood observed by visual inspection; clear boundary.; observed in vibracore tube. organic "rotting" odor

Oa3—60 to 103 centimeters (23.6 to 40.6 inches); dark reddish brown (5YR 2.5/2) broken face muck; very fluid; 10 percent by volume nonflat angular noncemented 10-20-30 millimeter wood observed by visual inspection; gradual boundary.; observed in vibracore tube. organic "rotting" odor

Oa4—103 to 117 centimeters (40.6 to 46.1 inches); black (5YR 2.5/1) broken face muck; moderately fluid; 2 percent by volume nonflat angular noncemented 10-20-30 millimeter wood observed by visual inspection.; observed in vibracore tube. organic "rotting" odor

UBL-3

IDENTIFIERS

Current Taxon Name (Soil Name): Catden
- OSD
- Series Extent
- Associated Components

User Site ID: 2019CT013003

User Pedon ID: 2019CT013003

Vegetation Plot ID: 2019CT013003

Lab Information:
- **Certified Lab Pedon Description -** no

Print Date: 2/25/2019

LOCATION

Location in Google Maps

Location in SoilWeb

Std. Latitude: 41.8268910

Std. Longitude: -72.4164040

Datum: WGS84

Location Description: Upper Bolton Lake, edge of tree stand and lake; water depth 7.5cm at time of observation

Country: US—United States

State: Connecticut

County: CT013—Tolland

MLRA: 144A—New England and Eastern New York Upland, Southern Part

Regional Office: 12—Amherst, MA

MLRA Soil Survey Area: 12-TOL—Tolland, Connecticut

Non-MLRA Soil Survey Area: CT600—State of Connecticut

PEDON

Describers Name: Jacob Isleib, Donald Parizek

Current Taxonomic Class: Euic, mesic Typic Haplosaprists

Current Taxon Kind: series

Pedon Type: undefined observation

Pedon Purpose: research site

Pedon Record Orgin: NASIS

Sampled As Information:
- **Soil Name -** Catden
- **Taxonomic Class -** Euic, mesic Typic Haplosaprists
- **Taxon Kind -** series
- **PSC -** 0 to 130 cm.
- **Classificaton Date -** 2/25/2019

SITE

Parent Material: woody organic material over herbaceous organic material and/or woody organic material over herbaceous organic material

Drainage Class: very poorly

Surface Fragments:

Benchmark Soil?: no

VEGETATION

SITE OBSERVATION

Observation Date: 2/20/2019 (actual site observation date)

Data Collector: Jacob Isleib, Donald Parizek

Surface Cover Properties:
- **Site Obs. Cover Kind 1 -** grass/herbaceous cover
- **Site Obs. Cover Kind 2 -** other grass/herbaceous cover
- **Pedoderm Loose Cover Indicator -** no

Drained? - no

Bedded Soil? - no

Forest Plantation? - no

Current Weather - overcast

Current Air Temp - -3

Classifier - Jacob Isleib

Soil Taxonomic Edition - twelfth edition

Moisture Class - peraquic

Moisture SUBClass - typic

Dynamic Soil Properties:

Pedon Cover Kind 1 - grass/herbaceous cover

Pedon Cover Kind 2 - other grass/herbaceous cover

Pedoderm Loose Cover Indicator - no

Pedon Vegetation and Crop Cover Information:

Forest Groundcover Veg. Type Dominant - perennial forbs or herbaceous

Hydric: yes

Pedon Text Note(s):

- Note: additional samples were collected below 321 centimeters that are not noted within the horizon descriptions

Pedon Horizon Lab Results - 1

Horizon	Top Depth	Bottom Depth	Sample ID	Data Collector	Total Clay	CaCO3 Clay	Total Silt	Fine Silt	Co. Silt	Total Sand	Total Sand Method	VC Sand	Co. Sand	Med. Sand	Fine Sand	VF Sand	VF Sand Method	Texture Class - Field Lab	Rubbed Fiber	Unrubbed Fiber	pH H2O
	cm	*cm*			*%*	*%*	*%*	*%*	*%*	*%*		*%*	*%*	*%*	*%*	*%*			*%*	*%*	
Oi	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	50	65	—
Oa1	—	65	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	20	—
Oa2	—	73	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	15	60	—
Oa3	—	156	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	40	—
Oa4	—	199	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	30	—
Oa5	—	223	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	20	—
Oa6	—	277	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	10	—
2Oi1	—	321	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55	70	—
2Oi2	—	349	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	60	80	—
3Oa1	—	421	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	60	—
3Oa2	—	530	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	5	—
3Oa3	—	800	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	5	—

Pedon Horizon Lab Results - 2

Horizon	Top Depth	Bottom Depth	Sample ID	pH CaCl2	pH NaF	pH Ox	Delta pH	LL	PL	PI	Atter. Samp. Cond.	COLE	Pot. Acidity	Ca + Mg - Meh 2	K	Ca + Mg - Sat. Paste	KCl Extract. Acidity	Base Sat. - Meh 2	CEC-7	CEC-8.2
	cm	*cm*						*%*	*%*	*%*		*cm/cm*	*meq/100g*	*cmol(+)/kg*	*cmol(+)/kg*	*mmol(+)/l*	*cmol(+)/kg*	*%*	*cmol(+)/kg*	*cmol(+)/kg*

Pedon Horizon Lab Results - 2

Horizon	Top Depth	Bottom Depth	Sample ID	pH CaCl2	pH NaF	pH Ox	Delta pH	LL	PL	PI	Atter. Samp. Cond.	COLE	Pot. Acidity	Ca + Mg - Meh 2	K	Ca + Mg - Sat. Paste	KCl Extract. Acidity	Base Sat. - Meh 2	CEC-7	CEC-8.2
	cm	*cm*						*%*	*%*	*%*		*cm/cm*	*meq/100g*	*cmol(+)/kg*	*cmol(+)/kg*	*mmol(+)/l*	*cmol(+)/kg*	*%*	*cmol(+)/kg*	*cmol(+)/kg*
Oi	0	20	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa1	20	65	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa2	65	73	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa3	73	156	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa4	156	199	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa5	199	223	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa6	223	277	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
2Oi1	277	321	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
2Oi2	321	349	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
3Oa1	349	421	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
3Oa2	421	530	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
3Oa3	530	800	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—

Pedon Horizon Lab Results - 3

Horizon	Top Depth	Bottom Depth	Sample ID	ECEC	Phosphate P	NO3-N	EC	EC Method	EC 1:5 by volume	CaCO3 Equiv.	Equiv. Gypsum	Na	SAR	Gypsum Req.	Humic Color	Fulvic Color	Humic + Fulvic Color	Al	PI	Pyro. Hue	PyrO. Value	Pyro. Chroma
	cm	*cm*		*cmol(+)/kg*	*mg/kg*	*mg/kg*	*dS/m*		*dS/m*	*%*	*%*	*mmol(+)/l*	*%*	*L-pcu/g*	*L-pcu/g*	*L-pcu/g*	*%*					
Oi	0	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa1	20	65	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa2	65	73	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa3	73	156	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa4	156	199	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa5	199	223	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa6	223	277	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2Oi1	277	321	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2Oi2	321	349	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3Oa1	349	421	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3Oa2	421	530	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3Oa3	530	800	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Vegetation Plot Plants

Plant Symbol	Scientific Name	National Vernacular Name	Plant Type Group	Canopy Cover %	Vegetation Stata Level

Vegetation Plot Plants

Plant Symbol	Scientific Name	National Vernacular Name	Plant Type Group	Canopy Cover %	Vegetation Stata Level
ALINR	Alnus incana ssp. rugosa	speckled alder	—	—	—
CAREX	Carex	sedge	—	—	—
CHCA2	Chamaedaphne calyculata	leatherleaf	—	—	—
CHTH2	Chamaecyparis thyoides	Atlantic white cedar	—	—	—
JUCA3	Juncus canadensis	Canadian rush	—	—	—
VAOX	Vaccinium oxycoccos	small cranberry	—	—	—

Pedon Diagnostic Features

Feature Kind	Feature Depth L-H	Feature Thickness L-RV-H
	cm	
fibric soil materials	0—20	—20—
aquic conditions	0—800	—800—
sapric soil materials	20—277	—257—
fibric soil materials	277—349	—72—
sapric soil materials	349—800	—451—

Setting and Climate

Slope	Slope Length USLE	Upslope Length	Elev.	Corr. Elev	Aspect	MAP	REAP	FFD	MAAT	MSAT	MWAT	MAST	MSST	MWST	MFFP	PE Index	Climate Station ID	Climate Station Name	Climate Station Type
%	*m*				*degrees*	*mm*	*mm*		*C*						*mm*				
0	—	—	204.8	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—

Oi—0 to 20 centimeters (0.0 to 7.9 inches); dark reddish brown (5YR 2.5/2) broken face peat; nonfluid; many very fine roots throughout and many medium roots throughout and many fine roots throughout; abrupt boundary.; wet, satiated when described; observed in macaulay sampler

Oa1—20 to 65 centimeters (7.9 to 25.6 inches); dark reddish brown (5YR 2.5/2) broken face muck; very fluid; common very fine roots throughout and common medium roots throughout and common fine roots throughout; 1 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 5 percent by volume nonflat angular noncemented 20-30-40 millimeter wood observed by visual inspection; abrupt boundary.; wet, satiated when described; observed in macaulay sampler. wood fragments are Atlantic White Cedar

Oa2—65 to 73 centimeters (25.6 to 28.7 inches); dark reddish brown (5YR 2.5/2) broken face woody muck; moderately fluid; 60 percent by volume nonflat angular noncemented 20-35-50 millimeter wood observed by visual inspection; abrupt boundary.; wet, satiated when described; observed in macaulay sampler. wood fragments are Atlantic White Cedar; 5 percent charcoal from 67 to 88 cm, sampled in 3 cm intervals

Oa3—73 to 156 centimeters (28.7 to 61.4 inches); very dusky red (2.5YR 2.5/2) broken face muck; very fluid; 10 percent by volume nonflat angular noncemented 20-25-30 millimeter wood observed by visual inspection; abrupt boundary.; wet, satiated when described; observed in macaulay sampler. wood fragments are Atlantic White Cedar; 5 percent charcoal from 127 to 148 cm

Oa4—156 to 199 centimeters (61.4 to 78.3 inches); very dusky red (2.5YR 2.5/2) broken face woody muck; very fluid; 2 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 20 percent by volume nonflat angular noncemented 20-45-70 millimeter wood observed by visual inspection; abrupt boundary.; wet, satiated when described; observed in macaulay sampler. wood fragments are Atlantic White Cedar and Birch; 170 to 180 cm grab sample collected

Oa5—199 to 223 centimeters (78.3 to 87.8 inches); very dusky red (2.5YR 2.5/2) broken face muck; very fluid; 5 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 5 percent by volume nonflat angular noncemented 20-35-50 millimeter wood observed by visual inspection; clear boundary.; wet, satiated when described; observed in macaulay sampler. large cedar fragment (150mm) at 202 to 216 cm; interval samples collected from 196 to 211 cm

Oa6—223 to 277 centimeters (87.8 to 109.1 inches); dark reddish brown (5YR 2.5/2) broken face muck; very fluid; 1 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 2 percent by volume nonflat angular noncemented 20-35-50 millimeter wood observed by visual inspection; abrupt boundary.; wet, satiated when described; observed in macaulay sampler. grab sample collected from 238 to 250 cm

2Oi1—277 to 321 centimeters (109.1 to 126.4 inches); dark reddish brown (5YR 2.5/2) broken face peat; slightly fluid; 1 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 2 percent by volume nonflat angular noncemented 20-35-50 millimeter wood observed by visual inspection; gradual boundary.; wet, satiated when described; observed in macaulay sampler. grab sample collected from 277 to 287 cm and 308 to 319 cm

2Oi2—321 to 349 centimeters (126.4 to 137.4 inches); very dark grayish brown (10YR 3/2) broken face peat; slightly fluid; 1 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 2 percent by volume nonflat angular noncemented 20-35-50 millimeter wood observed by visual inspection; gradual boundary.; wet, satiated when described; observed in macaulay sampler

3Oa1—349 to 421 centimeters (137.4 to 165.7 inches); black (7.5YR 2.5/1) broken face muck; very fluid; gradual boundary.; wet, satiated when described; observed in macaulay sampler

3Oa2—421 to 530 centimeters (165.7 to 208.7 inches); very dark brown (10YR 2/2) broken face muck; very fluid; gradual boundary.; wet, satiated when described; observed in macaulay sampler

3Oa3—530 to 800 centimeters (208.7 to 315.0 inches); very dark brown (10YR 2/2) broken face muck; very fluid; wet, satiated when described; observed in macaulay sampler. trace mica present

IDENTIFIERS

Current Taxon Name (Soil Name): SND

UBL-4

OSD

Series Extent

Associated Components

User Site ID: 2019CT013004

User Pedon ID: 2019CT013004

Lab Information:

Certified Lab Pedon Description - no

Print Date: 2/25/2019

LOCATION

Location in Google Maps

Location in SoilWeb

Std. Latitude: 41.8264150

Std. Longitude: -72.4168120

Datum: WGS84

Location Description: Upper Bolton Lake, subaqeuous area 28.5 meters at a heading of 230 deg from the wood duck nesting box southwest of the Atlantic White Cedar stand; water depth 48 cm at time of observation

Country: US—United States

State: Connecticut

County: CT013—Tolland

MLRA: 144A—New England and Eastern New York Upland, Southern Part

Regional Office: 12—Amherst, MA

MLRA Soil Survey Area: 12-TOL—Tolland, Connecticut

Non-MLRA Soil Survey Area: CT600—State of Connecticut

PEDON

Describers Name: Jacob Isleib, Donald Parizek

Current Taxonomic Class: Euic, mesic Sapric Frasiwassists

Current Taxon Kind: family

Pedon Type: undefined observation

Pedon Purpose: research site

Pedon Record Orgin: NASIS

Sampled As Information:

Soil Name - SND

Taxonomic Class - Euic, mesic Sapric Frasiwassists

Taxon Kind - family

PSC - 0 to 130 cm.

Classificaton Date - 2/25/2019

SITE

Parent Material: woody organic material over herbaceous organic material and/or woody organic material over herbaceous organic material

Drainage Class: subaqueous

Surface Fragments:

Benchmark Soil?: no

VEGETATION

SITE OBSERVATION

Observation Date: 2/20/2019 (actual site observation date)

Data Collector: Jacob Isleib, Donald Parizek

Surface Cover Properties:

Site Obs. Cover Kind 1 - water cover

Pedoderm Loose Cover Indicator - no

Drained? - no

Bedded Soil? - no

Forest Plantation? - no

Current Weather - overcast

Current Air Temp - -3

Classifier - Jacob Isleib

Soil Taxonomic Edition - twelfth edition

Moisture Class - peraquic

Moisture SUBClass - typic

Dynamic Soil Properties:

Pedon Cover Kind 1 - water cover

Pedoderm Loose Cover Indicator - no

Hydric: no

Pedon Horizon Lab Results - 1

Horizon	Top Depth	Bottom Depth	Sample ID	Data Collector	Total Clay	CaCO3 Clay	Total Silt	Fine Silt	Co. Silt	Total Sand	Total Sand Method	VC Sand	Co. Sand	Med. Sand	Fine Sand	VF Sand	VF Sand Method	Texture Class - Field Lab	Rubbed Fiber	Unrubbed Fiber	pH H2O
	cm	*cm*			*%*	*%*	*%*	*%*	*%*	*%*		*%*	*%*	*%*	*%*	*%*			*%*	*%*	
Oe	—	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	40	—
Oa1	—	135	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	40	—
Oa2	—	186	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	35	—
O'e	—	237	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20	50	—
2Oi	—	273	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	45	70	—
3Oa1	—	405	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	35	—
3Oa2	—	705	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—

Pedon Horizon Lab Results - 2

Horizon	Top Depth	Bottom Depth	Sample ID	pH CaCl2	pH NaF	pH Ox	Delta pH	LL	PL	PI	Atter. Samp. Cond.	COLE	Pot. Acidity	Ca + Mg - Meh 2	K	Ca + Mg - Sat. Paste	KCl Extract. Acidity	Base Sat. - Meh 2	CEC-7	CEC-8.2
	cm	*cm*						*%*	*%*	*%*		*cm/cm*	*meq/100g*	*cmol(+)/kg*	*cmol(+)/kg*	*mmol(+)/l*	*cmol(+)/kg*	*%*	*cmol(+)/kg*	*cmol(+)/kg*
Oe	0	35	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa1	35	135	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
Oa2	135	186	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
O'e	186	237	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
2Oi	237	273	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
3Oa1	273	405	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—
3Oa2	405	705	—	—	—	—	—	—	—		—	—	—	—	—	—	—	—	—	—

Pedon Horizon Lab Results - 3

Pedon Horizon Lab Results - 3

Horizon	Top Depth	Bottom Depth	Sample ID	ECEC	Phosphate P	NO3-N	EC	EC Method	EC 1:5 by volume	CaCO3 Equiv.	Equiv. Gypsum	Na	SAR	Gypsum Req.	Humic Color	Fulvic Color	Humic + Fulvic Color	Al	PI	Pyro. Hue	PyrO. Value	Pyro. Chroma
	cm	*cm*		*cmol(+)/kg*	*mg/kg*	*mg/kg*	*dS/m*		*dS/m*	*%*	*%*	*mmol(+)/l*	*%*	*L-pcu/g*	*L-pcu/g*	*L-pcu/g*	*%*					
Oe	0	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa1	35	135	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oa2	135	186	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
O'e	186	237	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2Oi	237	273	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3Oa1	273	405	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3Oa2	405	705	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Setting and Climate

Slope	Slope Length USLE	Upslope Length	Elev.	Corr. Elev	Aspect	MAP	REAP	FFD	MAAT	MSAT	MWAT	MAST	MSST	MWST	MFFP	PE Index	Climate Station ID	Climate Station Name	Climate Station Type
%	*m*				*degrees*	*mm*	*mm*		*C*						*mm*				
0	—	—	204.5	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—

Oe—0 to 35 centimeters (0.0 to 13.8 inches); very dark brown (10YR 2/2) broken face mucky peat; moderately fluid; 10 percent by volume nonflat angular noncemented 20-30-70 millimeter wood observed by visual inspection; gradual boundary.; wet, satiated when described; observed in macaulay sampler

Oa1—35 to 135 centimeters (13.8 to 53.1 inches); dark reddish brown (5YR 3/2) broken face muck; very fluid; 2 percent by volume nonflat subangular noncemented 2-4-5 millimeter charcoal observed by visual inspection and 10 percent by volume nonflat angular noncemented 20-30-70 millimeter wood observed by visual inspection; clear boundary.; wet, satiated when described; observed in macaulay sampler

Oa2—135 to 186 centimeters (53.1 to 73.2 inches); very dark brown (7.5YR 2.5/2) broken face muck; very fluid; 10 percent by volume nonflat angular noncemented 20-30-70 millimeter wood observed by visual inspection; gradual boundary.; wet, satiated when described; observed in macaulay sampler

O'e—186 to 237 centimeters (73.2 to 93.3 inches); black (10YR 2/1) broken face mucky peat; moderately fluid; 5 percent by volume nonflat angular noncemented 20-30-70 millimeter wood observed by visual inspection; clear boundary.; wet, satiated when described; observed in macaulay sampler

2Oi—237 to 273 centimeters (93.3 to 107.5 inches); very dark brown (7.5YR 2.5/2) broken face peat; slightly fluid; 2 percent by volume nonflat angular noncemented 20-30-70 millimeter wood observed by visual inspection; gradual boundary.; wet, satiated when described; observed in macaulay sampler

3Oa1—273 to 405 centimeters (107.5 to 159.4 inches); very dark brown (7.5YR 2.5/2) broken face muck; very fluid; gradual boundary.; wet, satiated when described; observed in macaulay sampler

3Oa2—405 to 705 centimeters (159.4 to 277.6 inches); very dark brown (10YR 2/2) broken face muck; very fluid; wet, satiated when described; observed in macaulay sampler