May 2019

PENNICHUCK WATER WORKS
HARRIS POND DREDGE FEASIBILITY STUDY

Prepared for:

PENNICHUCK

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Executive Summary

The purpose of this project was to assess how much additional raw water supply storage could be obtained through dredging and other methods in Pennichuck Brook in the case it is needed as an emergency alternative water source under worst case conditions, for example, if the Merrimack River source were to be inoperable for an extended time under emergency conditions.

This report summarizes the feasibility study, which is partially funded under the 2018 New Hampshire Department of Environmental Services (NHDES) Source Water Protection Grant (SWPG), involving a dredging feasibility study for Harris Pond.

As a separate effort from this study, other options of increasing active storage volume were considered based on issues that could arise with dredging including constructability, time to completion, cost, permitting, and longevity of the mitigation measure. These options include water level / outlet adjustments and installation of a series of deep raw water supply wells.

There are three primary considerations for dredging projects: 1) how will natural resources like wetlands be impacted; 2) what are the sediments qualities and quantities; 3) what types of dredging are feasible including where will the sediments be stored to dewater; and 4) what are the costs and practical considerations. These are discussed in the remaining sections of the report.

The conclusion of the dredge feasibility analysis is that while feasible, all of the dredging options are costly in comparison to the benefit in increased storage. The alternative options identified outside this scope and presented in the document entitled "Options to Increase Storage in Pennichuck Brook" identified several options that are under consideration by PWW. These are presented in Exhibit 1.

1.0 Project Background

Pennichuck Water Works (PWW), established in 1852, is the largest subsidiary of the Pennichuck Corporation engaged in the collection, storage, treatment, distribution, and sale of potable water. PWW serves the City of Nashua, New Hampshire and 10 surrounding municipalities, supplying water to population of approximately 110,000.

PWW collects its water from the Pennichuck Brook Watershed, which includes five Southern New Hampshire towns (Nashua, Merrimack, Amherst, Milford, and Hollis) and has an overall area of 17,300 acres. The primary water supply consists of about 195 acres of water in a series of chain ponds that includes Harris Pond, Bowers Pond, Holts Pond, and various smaller upstream ponds. The drinking water reservoirs were created in the late 1800s as a result of damming portions of Pennichuck Brook. The upper Pennichuck Brook Watershed mostly consists of rural areas; the watershed is more developed closer to the ponds, with a highly developed corridor consisting of commercial, industrial, and high-density residential developments running through portions of Amherst, Merrimack, and Nashua. The major state highway, Everett Turnpike, also runs through the lower watershed area and intersects Bowers Pond. The entire Pennichuck Brook Watershed is depicted in **Appendix A**. All of the supply ponds are shown on the USGS topographical map in **Appendix B**.

Comprehensive Environmental, Inc. (CEI) has worked on behalf of PWW between the years of 2000 and 2018 to evaluate sediment accumulation and sediment inputs in the PWW water supply ponds. The primary goals of these investigations were to (1) characterize the areas where storage was being lost, (2) estimate the rate of storage loss, and (3) develop measures to reduce storage loss and improve water supply storage capacity within the ponds where feasible. The most recent assessment of sediment accumulation, sources, and inputs was completed in 2017. This assessment, *Reservoir Storage Estimates & Tributary and Pond Sediment Accumulation Monitoring, 2017*, completed by CEI, concluded that both Harris and Bowers Ponds could benefit from dredging to increase active storage volume. Harris Pond, however, contains the greatest volume of sediments occupying the active storage area. Accumulated sediment is occupying active storage within Harris Pond that would otherwise be dedicated to drinking water supply; this sediment accumulation also has the potential to migrate down to the water treatment plant (WTP), as Harris Pond is the closest supply pond to the WTP. Additionally, according to previous studies completed by CEI, including the *Bowers & Harris Pond Sediment Analysis Study, 2013*, there are indications that sediment is moving around within Harris Pond due to currents and inflow, and has been accumulating in some areas and scouring away in other areas over the past 20 years. Sediment is also migrating into downstream supply ponds and reducing available water storage downstream. As a result of these assessments, PWW decided to explore the feasibility of dredging Harris Pond.

This study, which is partially funded under the 2018 New Hampshire Department of Environmental Services (NHDES) Source Water Protection Grant (SWPG), will involve a dredging feasibility study for Harris Pond. PWW has selected CEI to perform the study, which will evaluate the alternatives, logistics, and costs associated with dredging the pond. A Quality Assurance Project Plan (QAPP) has also been completed and this study has been conducted according to the provisions in the QAPP; the final QAPP with all required signatures is included in **Appendix I**.

2.0 Existing Conditions and Environmental Resources

2.1 Wetlands

According to the National Wetland Inventory map (**Appendix C**) obtained from the U.S. Fish and Wildlife online wetlands database, there are no wetlands surrounding Harris Pond except for a small freshwater forested/shrub wetland, which abuts the Harris Pond on the south west side.

2.2 Sediment Analysis

This section describes the sediment classification and sediment distribution within Harris Pond, including sediment profiles and laboratory analysis of the sediment. Sediment characteristics presented in this study are based on the following sources of sediment classification, distribution, sampling, and results:

1. Bowers & Harris Pond Sediment Analysis Study (CEI). The soil borings were analyzed (physical properties) by S.W. Cole Engineering, Inc. and completed in 2013. Sediment borings were obtained by Soil Exploration and profiles were produced by CEI.
2. Harris Pond Dredging Sediment Chemical Analysis Report (CEI). The soil samples were analyzed (chemical properties) by ChemServe Environmental Analytics and completed in 2018.

2.2.1 Physical Characteristics

CEI subcontracted Soil Exploration to perform soil sediment borings from a floating barge in 13 pre-determined locations along Harris and Bowers Pond in 2013. Six of the borings were located within Harris Pond (TB-1 to TB-6). Boring locations were selected based on previous sediment depth mapping, focusing on vicinity to incoming tributaries and existing sediment deltas. These locations were selected to represent the incoming sediments and sediments that have been accumulating over the past 20 years. Sediment core samples were retrieved at each boring location at 4-foot depth intervals to a maximum depth of 12 feet. These cores began at the soil/water interface and were terminated when substantial amounts of clay, silt, mud, or solid sand was encountered. If refusal was encountered before 12 feet, or if the slide hammer could no longer advance the sample tube, it was assumed that the core had reached the original pond bottom prior to the construction of the dams. Boring core logs, profiles, and locations are included in **Appendix D**.

The boring core observations were completed to evaluate potential dredging methods based on sediment composition and depth to refusal. According to these boring cores, the material collected for each sample included a mixture of gravel, sands, and silts; organic material (decomposed plant and animal matter); and water. The observations indicate that the samples have a very high water content, which is expected from pond-bed sediment samples. According to the boring core logs and profiles, a layer of black organic material was encountered in most of the borings within Harris Pond; organic material comprised of the top 4 feet of each of the six borings and this depth likely covers the entire pond bottom. This organic material represents decaying plant matter that accumulates every year, including lily pads, grass, cyanobacteria, forest debris, and other organic material that dies and settles at the bottom of the pond. Underneath the organic material, the cores revealed a transition to sand or silty sand; some borings contained sand continuously throughout the core. All soil borings eventually encountered substantial amounts of clay, silt, mud, or solid sand material, or reached refusal at 8 feet below the soil/water interface within Harris Pond, with the exception of one boring (TB-3) which reached 12 feet below the soil/water interface.

Ten 3-inch long soil samples from one of the 13 soil cores (TB-9), which was taken from Bowers Pond, were sent to S.W. Cole Engineering, Inc. for laboratory gradation analysis to characterize the physical

composition of sediments found in the ponds. This lab analysis was completed to evaluate potential dredging methods based on sediment composition. The sediment samples were collected and analyzed for grain size (wet sieve analysis), using ASTM C117, C136 / AASHTO T11, T27 sampling and analysis protocol. The sieve analysis results showed that the sediment is poorly graded and made up of mostly sand and fine materials (**Table 2-1**). Fine material averaged approximately 39.6% across all samples passing through the #200 sieve and sand material averaged approximately 76.5% across all samples passing through the #40 sieve. These laboratory results indicate the material would generate a large volume of residual water when dewatering the sediment. The laboratory sieve analysis report produced by S.W. Cole Engineering, Inc. is included in **Appendix E**.

Table 2-1. Sediment Sample Sieve Analysis Results

Standard Designation	Sieve Size	Percent Finer (%)									
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
25.00 mm	1"	---	---	---	---	---	100	---	---	---	---
19.00 mm	3/4"	---	---	---	---	---	100	---	100	---	---
12.50 mm	1/2"	---	---	---	---	---	99	---	97	---	---
9.50 mm	3/8"	---	---	---	---	---	98	---	97	---	---
6.30 mm	1/4"	---	---	---	---	100	92	---	93	---	---
4.75 mm	No. 4	100	100	100	100	99	86	100	91	100	100
2.00 mm	No. 10	100	100	99	100	84	70	97	87	100	100
850 um	No. 20	100	99	98	100	66	52	57	85	99	100
425 um	No. 40	97	98	92	95	47	24	30	85	99	98
250 um	No. 60	92	93	56	45	13	8	17	84	98	94
150 um	No. 100	82	78	20	8	2	3	13	84	98	91
75 um	No. 200	62.6	54.1	5.5	1.9	1	1.3	9.4	80	95.8	84

2.2.2 Chemical Characteristics

One composite sample was collected from Harris Pond in 2018 to characterize the chemical composition of sediments found in Harris Pond by ChemServe Environmental Analytics. This lab analysis was completed to evaluate potential disposal/reuse options of the potential dredged material. The composite sample was analyzed for several constituents including New Hampshire Department of Environmental Services (NHDES) regulated contaminants for soil remediation and Environmental Protection Agency (EPA) Residential Soil Regional Screening Levels (RSL). The composite sediment sample results were compared with the State's soil remediation standards (Env-Or 606.19, Table 600-2 in the New Hampshire Code of Administrative Rules) and the most stringent Federal residential soil RSLs, and summarized in **Table 2-2**. As shown, the sediment within Harris Pond did not exceed any of the soil remediation standards or residential soil RSLs. Concentrations with a "<" symbol represent the laboratory detection limit for a particular constituent. Bold numbers represent concentrations that were above laboratory detection limits, however did not exceed any standards. Numbers highlighted in yellow, orange, and red represent laboratory detection limits or concentrations higher than the soil remediation standard, the residential soil RSL, or both, respectively. In the cases where the detection limit is not low enough, presence of contamination, or whether a release above the soil remediation standard or residential soil RSL has occurred, cannot be determined.

These cursory results informs if any potential issues could arise for required sediment disposal and reuse; additional samples throughout the pond will be warranted if dredging is selected as a viable option in the future. The complete laboratory chemical analysis report produced by ChemServe Environmental Analytics for the 2018 composite sample is included in **Appendix F**.

Table 2-2. Sediment Sample Chemical Analysis Results

Sample ID:	Soil Remediation Standard (Env-Or 606.19)	EPA Residential Soil RSL		Harris Pond Sediment
Lab Sample ID:		Carcinogenic SL TR = 1*10-6	Non-carcinogenic SL Child THQ = 1	18080245-001
Sample Date:				8/10/2018
Metals (mg/kg)				
Cadmium	33	2100	71	< 0.74
Chromium (III)	1000	---	120000	**7.9**
Chromium (VI)	130	0.3	230	< 5.92
Lead	400	---	400	**18.4**
Mercury	7	---	11	**0.097**
Nickel	400	15000	1500	**7.4**
Selenium	180	---	390	< 7.4
Silver	89	---	390	< 0.74
Zinc	1000	---	23000	**46.4**
Total Petroleum Hydrocarbons (TPH) (mg/kg)				
Total Petroleum Hydrocarbons	10000	---	---	< 95.0
TPH as Diesel	10000	---	---	< 95.0
TPH as Lube Oil	10000	---	---	< 95.0
Semi-Volatile Organic Compounds (mg/kg)				
Acenaphthene	340	---	3600	< 0.900
Acenaphthylene	490	---	---	< 0.900
Anthracene	1000	---	18000	< 0.900
Benzo(a)anthracene	1	1.1	---	< 0.900
Benzo(a)pyrene	0.7	0.11	18	< 0.900
Benzo(b)fluoranthene	1	1.1	---	< 0.900
Benzo(k)fluoranthene	12	11	---	< 0.900
Chrysene	120	110	---	< 0.900
Dibenzo(a,h)anthracene	0.7	0.11	---	< 0.900
Fluoranthene	960	---	2400	< 0.900
Fluorene	77	---	2400	< 0.900
Indeno(1,2,3-cd)pyrene	1	1.1	---	< 0.900
Methylnaphthalene, 2-	96	---	240	< 0.900
Naphthalene	5	3.8	130	< 0.900
Pyrene	720	---	1800	< 0.900
Volatile Organic Compounds (mg/kg)				
Acetone	75	---	61000	< 0.320
Acrylonitrile	0.5	0.25	16	< 0.130
Benzene	0.3	1.2	82	< 0.025
Bromodichloromethane	0.1	0.29	1600	< 0.025
Bromoform	0.1	19	1600	< 0.025
Bromomethane	0.3	---	6.8	< 0.025
Butylbenzene, n-	110	---	3900	< 0.025
Butylbenzene, sec-	130	---	7800	< 0.025
Butylbenzene, tert-	100	---	7800	< 0.025
Carbon disulfide	460	---	770	< 0.025
Carbon tetrachloride	12	0.65	100	< 0.051
Chloromethane	3	---	110	< 0.025
Chlorotoluene, 2 (o)	15	---	1600	< 0.025
Chlorotoluene, 4 (p)	680	---	1600	< 0.025

Table 2-2. Sediment Sample Chemical Analysis Results (cont.)

Sample ID:	Soil Remediation Standard (Env-Or 606.19)	EPA Residential Soil RSL		Harris Pond Sediment
Lab Sample ID:		Carcinogenic SL TR = 1*10-6	Noncarcinogenic SL Child THQ = 1	18080245-001
Sample Date:				8/10/2018
Volatile Organic Compounds (mg/kg)				
Dibromochloromethane	1	8.3	1600	< 0.025
Dibromochloropropane	0.1	0.01	4.7	< 0.051
Dichlorobenzene, 1,2- (o-DCB)	88	---	1800	< 0.025
Dichlorobenzene, 1,3- (m-DCB)	150	---	---	< 0.025
Dichlorobenzene, 1,4- (p-DCB)	7	2.6	3400	< 0.025
Dichlorodifluoromethane	1000	---	87	< 0.025
Dichloroethane, 1,1-	3	3.6	16000	< 0.025
Dichloroethane, 1,2-	0.1	0.46	31	< 0.025
Dichloroethylene, 1,1-	14	---	230	< 0.025
Dichloroethylene, trans-1,2-	9	---	1600	< 0.025
Dichloromethane (Methylene chloride)	0.1	57	350	< 0.130
Dichloropropane, 1,2-	0.1	2.5	16	< 0.025
Dichloropropene, 1,3-	0.1	1.8	72	< 0.010
Diethyl ether	3900	---	16000	< 0.025
Diisopropyl ether (DIPE)	10	---	2200	< 0.025
Ethyl tert butyl ether (ETBE)	0.7	---	---	< 0.025
Ethylbenzene	120	5.8	3400	< 0.025
Ethylene dibromide	0.1	0.04	73	< 0.025
Hexachlorobutadiene	17	1.2	78	< 0.025
Isopropyl benzene	330	---	1900	< 0.025
Methyl ethyl ketone (MEK)	51	---	27000	< 0.32
Methyl isobutyl ketone (MIBK)	29	---	33000	< 0.25
Methyl tert butyl ether (MTBE)	0.2	47	15000	< 0.025
Monochlorobenzene	6	---	280	< 0.025
Naphthalene	5	3.8	130	< 0.051
Propyl benzene, n-	85	---	3800	< 0.025
Styrene	17	---	6000	< 0.025
Tertiary amyl methyl ether (TAME)	3	---	---	< 0.025
Tertiary butyl alcohol (TBA)	2	---	---	< 0.510
Tetrachloroethane, 1,1,1,2-	0.8	2	2300	< 0.025
Tetrachloroethane, 1,1,2,2,-	4	0.6	1600	< 0.025
Tetrachloroethylene (PCE)	2	24	81	< 0.025
Toluene	100	---	4900	< 0.025
Trichlorobenzene, 1,2,4-	19	24	58	< 0.025
Trichloroethane, 1,1,1-	78	---	8100	< 0.025
Trichloroethane, 1,1,2-	0.1	1.1	1.5	< 0.025
Trichloroethylene (TCE)	0.8	0.94	4.1	< 0.025
Trichlorofluoromethane	1000	---	23000	< 0.025
Trichloromethane (Chloroform)	3	0.32	200	< 0.025
Trichloropropane, 1,2,3-	0.1	0.01	4.8	< 0.025
Trimethylbenzene, 1,2,4	130	---	300	< 0.025
Trimethylbenzene, 1,3,5	96	---	270	< 0.025
Vinyl chloride	1	0.06	70	< 0.025
Xylenes (mixed isomers)	500	---	580	< 0.025

2.3 Storage/Reuse/Disposal Options

According to Env-Or 611 in the New Hampshire Code of Administrative Rules, there are two types of contaminated soil as defined by the following:

- Non-hazardous oil-contaminated soil (NCOS) – soil that is contaminated with oil; soil that is not a hazardous waste as defined by RSA 147-B: 2, VII; and, soil that is certified as NCOS in accordance to Env-Or 611.03.
- Non-hazardous contaminated soil (NCS) – soil that contains a regulated contaminant; soil that is not a hazardous waste as defined by RSA 147-B: 2, VII; and, soil that cannot be certified as an NCOS in accordance to Env-Or 611.03.

According to the data (**Table 2-2**), the Harris Pond dredge material is not contaminated with oil since TPH was not detected. The soil does contain regulated contaminants over laboratory detection limits including chromium (III), lead, mercury, nickel, and zinc; however, metals are commonly found in natural soils and not necessarily indicative of a release of hazardous material. The concentrations also do not exceed the State soil remediation standards or EPA residential soil RSLs. The laboratory detection limit for one compound, dichloromethane, was higher than the associated State soil remediation standard only. The laboratory detection limit for three compounds, including chromium (VI), dibromochloropropane, and 1,2,3-trichloropropane, were higher than the associated Federal residential soil regional screening level (RSL) only. The laboratory detection limit for two compounds, including benzo(a)pyrene and dibenzo(a,h)anthracene, were higher than the associated State soil remediation standard and Federal residential soil regional screening level (RSL). Without additional data, it cannot be confirmed that soil meets the State and/or Federal standards for these particular constituents. If additional sampling is proposed in the future, it must be confirmed that the laboratory can provide detection limits that are below state and federal standards for all parameters.

Based on this one composite sample, the dredge material can be classified as NCS that does not exceed any of the soil remediation standards. According to Env-Or 611.06 (d), this soil may be left in place, reused on-site, reused off-site depending on land ownership and land use, or removed from the site to an authorized treatment or disposal facility. However, if dredging is selected as a viable option to increase active storage in Harris Pond, additional sampling will be required to accurately characterize the chemical composition of the dredge material that will be removed. An example sampling protocol could be as follows: one sample per 2,000 CY up to 20,000 CY, and then one sample per 10,000 CY. If the lab results are consistently below soil remediation standards, fewer samples could be necessary. Conversely, if the lab results are above soil remediation standards, more sampling may be warranted. If there are isolated instances of contamination, different classifications of dredge material or solid waste can be managed separately. Isolated pockets of contaminated material and handling may be treated separately from material with results below soil remediation standards.

If further sampling were to reveal that the dredge material did contain contaminants above soil remediation standards, the dredge material will fall under the jurisdiction of the NHDES Waste Management Division and the sampling protocol, reuse, and disposal methods will be subject to review. According to guidance for contaminated soil storage (Env-Or 611.05), NOCS or NCS that exceeds any of the soil remediation standards may be temporarily stored on-site awaiting off-site disposal for a period of no longer than 4 months. The stored soil must be stored in a manner that prevents contact with the ground, precipitation, storm water run-off. Therefore, the temporary stockpile must be place on top of and covered by impermeable material, which is chemically compatible with the contamination. The temporary stockpile must only be uncovered when soil is being added or removed for off-site disposal. According to guidance for contaminated soil disposal and reuse (Env-Or 611.06), NOCS or NCS that exceeds any of the soil

remediation standards shall be managed on-site only if it is an approved remedial action by the department, meets site-specific standards, or is in accordance with a department-approved AUR. The soil must otherwise be removed from the site to an authorized treatment or disposal facility.

As the project moves forward and further sampling is proposed/required, coordination with Waste Management Division is required prior to sampling to develop a sampling collection, analysis and reuse/disposal plan. Sampling frequencies may be based on the initial sampling results / screening and if results consistently show no contamination over soil remediation standards, then the sampling frequency may be decreased. As part of the sampling and reuse/disposal plan development, it will be under Waste Management Division's discretion whether the dredge material must meet other standards or whether specific ASTM sampling methods are used. Additionally, pockets of contaminated material may be segregated, handled and treated separately instead of homogenizing all of the dredge material. Reuse or disposal of the dredge material will be based on several factors including potential risks and receptors associated with land use of the reuse site, disposal facility requirements, level of contamination, need for treatment, volume of material, etc. All of this information will be submitted and reviewed by the Waste Management Division for final approval of the sampling and reuse/disposal plan.

Additional sampling will incur additional cost. Associated disposal or reuse costs include the cost of loading, hauling, spreading for reuse, treatment, and/or disposal facility fees. Disposal and treatment costs will vary depending on the facility, volume of dredge material, transportation logistics. Additionally, PFAS sampling has not been completed for the Harris Pond dredge material, and results of such sampling may affect the status of the dredge material as a solid waste.

2.4 Sediment Mapping

Bathymetric mapping has been created using geographic information system (GIS) software and a mesh of several sources of bathymetric data that has been collected for Harris Pond over the last 10 years, including the following:

1. Bathymetric mapping of Harris Pond via simplified sonar methods (CEI) obtained between 2013 and 2018; and
2. Bathymetric mapping of Harris Pond via echo-sounding & multi-beam sonar (Substructure, Inc. / CEI) obtained in 2011.

Geographic Information System (GIS) software was used to create a bathymetric contour map for Harris Pond and Bowers Pond. A field crew (CEI) used simplified sonar methods to obtain the bathymetry of outer shallow regions of the ponds in 2013. A detailed bathymetric survey was completed by Substructure, Inc. using echo-sounding & multi-beam sonar in the deeper regions of the ponds in 2011. For a more complete idea of the bathymetric contours, both bathymetric surveys were meshed in GIS to create one bathymetric map. Using this rationalized information, active and dead storage was estimated based on the limiting elevations. As can be seen in the bathymetric map provided in **Appendix G**, Harris Pond is split into an upper and lower portion before the dam. The upper portion of Harris Pond is bounded by the dam between Bowers Pond and Harris Pond, and the Manchester Street Bridge; the lower portion of Harris Pond is bounded by the Manchester Street Bridge, and the dam between Harris Pond and the Supply Pond.

The map and analysis information were used to estimate the quantity and quality of sediment and assist in determining potential dredging alternatives and disposal/reuse options, along with associate costs.

2.5 Active Storage Analysis

Normal water level in Harris Pond is at approximately 168.17' (all elevations are on the NGVD29 datum). The limiting elevation for the upper portion of Harris Pond is the elevation of the pond bottom under the Manchester Street Bridge. According to the bathymetric data, the elevation in this area is 151.17', or 17 feet below the water surface. However, due to an assumption that approximately 3 feet of sediment may be dredged under the Manchester Street Bridge, the limiting elevation for the upper portion of Harris Pond was adjusted to elevation 148.17', or 20 feet below the water surface. The limiting elevation for the lower portion of Harris Pond is the elevation of the dam spillway, which is at elevation 142.17', or 26 feet below the water surface. Normal water level in Bowers Pond is at approximately 178.00'. The limiting elevation for Bowers is the elevation of the dam spillway, which is at elevation 167.88', or 10.12' feet below the water surface.

Based on these limiting elevations, the volume of active storage (water volume above limiting elevations) and dead storage (water volume below limiting elevations) was calculated for Harris and Bowers Pond. The dead storage in the upper and lower portion of Harris Pond is approximately 5.4 million and 1.1 million gallons, respectively. The active storage in the upper and lower portion of Harris Pond is approximately 188.2 million and 159.3 million gallons, respectively. Therefore, the total active storage in Harris Pond is approximately 347.5 million gallons. The active and dead storage in Bowers Pond is 148.1 million gallons and 58.6 million gallons, respectively. A summary of these results is provided in **Table 2-3** below.

Table 2-3. Harris Pond Active and Dead Storage Summary

Area	Normal Pool Elev.	Limiting Depth	Limiting Elevation	Active Storage (gal)	Dead Storage (gal)
Upper Harris Pond	168.17	20'	148.17'	188,183,185	5,430,362
Lower Harris Pond		26'	142.17'	159,295,962	1,087,914
Harris Pond		varies	varies	347,479,147	6,518,276
Bowers Pond	178.00	10.12'	167.88'	148,073,782	58,591,779

Based on the PWW raw water intake consumption, the approximate daily demand is 10 million gallons per day (mgd). The daily base flow to Harris Pond, including all of the upstream subwatersheds, is approximately 31.8 mgd or 3 days of supply per day. The volume of water in Harris Pond and Bowers Pond that can be accessed (active storage) provides approximately 50 days of water supply. In addition to the supply ponds, PWW also withdraws water from the Merrimack River to meet demands. A summary supply from active storage only, from Harris Pond and Bowers Pond, is provided in **Table 2-4** below.

Table 2-4. Harris Pond Existing Supply

Area	Active Storage (gal)	Days of Supply*
Upper Harris Pond	188,183,185	19
Lower Harris Pond	159,295,962	16
Harris Pond	**347,479,147**	**35**
Bowers Pond	**148,073,782**	**15**
Total	**495,552,929**	**50**

*Based on a daily raw water intake consumption of 10 mgd.

During a worst-case scenario, however, where the supply from upstream sources and the watershed is cutoff in the event of an extreme drought and the Merrimack River pump is not operational, PWW must rely on the active storage in the supply ponds. The PWW Merrimack River supply pumps would take approximately 145 days replace in the event of a failure. Several dredging scenarios were considered to

determine the potential supply days from active storage that could be gained Harris Pond to mitigate loss of supply during this worst-case conditions. Based on these analyses, the maximum days of supply that can be gained in Harris Pond via dredging is 8 days, which makes the total Harris Pond supply 43 days. The dredging options that were analyzed include the following:

1. Dredging the entire Harris Pond to the maximum depths (limiting active storage elevation) and maintaining 3:1 side slopes within the pond.
    - **Gain in Active Storage: 80.1 million gallons (8 days of supply)**
    - Sediment Volume Removed: 400,000 CY of dredge material removed

2. Dredging the entire Upper Harris Pond to a maximum depth of 20' (limiting active storage elevation) and maintaining 3:1 side slopes within the pond.
    - **Gain in Active Storage: 50.9 million gallons (5 days of supply)**
    - Sediment Volume Removed: 255,000 CY of dredge material removed

3. Dredging the entire Lower Harris Pond to a maximum depth of 26' (limiting active storage elevation) and maintaining 3:1 side slopes within the pond.
    - **Gain in Active Storage: 29.2 million gallons (3 days of supply)**
    - Sediment Volume Removed: 145,000 CY of dredge material removed

4. Dredging the entire Harris Pond, only first 4' of material and maintaining existing side slopes.
    - **Gain in Active Storage: 26.2 million gallons (3 days of supply)**
    - Sediment Volume Removed: 130,000 CY of dredge material removed

The dredging alternatives discussed in Section 3.0 are based on dredging the maximum potential volume for Harris Pond, which is approximately 400,000 CY of material, to gain 8 days of supply.

3.0 Dredging Alternatives

3.1 Mechanical Dry Dredging

Description

Mechanical dry dredging involves the removal of sediment and plant material using standard construction equipment in the dry. It is usually performed by scraping and removing sediment and plant material with a backhoe, excavator, or a front-end loader. The pond must be fully drained to a predetermined level, and then a machine is brought in to remove sediments and plant material in the dry. The dredged material is typically not very wet and is expected to consist of mostly solids. The dredged material is collected and deposited on shore, where it is staged, dewatered (if needed), and stored for reuse or disposal. Water produced from any dewatering may be returned to the pond. The plant species removal is non-selective and can be performed in any season. The purpose of mechanical dry dredging is to return a pond to its pre-sedimentation conditions or increase accessible pond storage for additional water supply. Other benefits to mechanical dry dredging include controlling excessive aquatic plant and algae growth within the pond.

Feasibility/ Strengths/ Weaknesses

Mechanical dry dredging is the most effective dredging method in reducing sediment levels and plant growth in shallow and deep areas to increase active storage. This method is effective when the dredge material contains large obstructions. This dredging approach also typically requires the least amount of future maintenance. Mechanical dry dredging requires the least amount of dewatering, however, this method requires a full pond drawdown, which is only feasible for a maximum duration of 3-months during the low-demand season (fall/winter/spring).

Environmental Impacts

<u>Benefits</u>:

- Water quality improvement;
- Enhanced pollutant trapping capabilities;
- Increased dilution of nutrient loads;
- Control rooted plant and algae growth rate;
- Removal of unwanted material in sediment;
- Larger depth gradients and opportunities for habitat diversity; and,
- Long-term benefits to fisheries and wildlife habitat from water quality enhancement, aquatic plant control, and physical habitat enhancement;

<u>Detriments</u>:

- Pond drawdown will temporarily cut-off water supply to PWW from upstream ponds for the duration of construction;
- Temporary destruction of shallow biological habitats due to physical disturbance and pond drawdown;
- Potential increase in downstream turbidity due to physical disturbance and pond drawdown if mitigation measures are not well maintained;
- Temporary upland alteration of terrain from staging, dewatering, storage, and truck routes; and

- Potential permanent upland alteration of terrain if dredged material is reused on or off-site.

Permitting Requirements

- U.S. Army Corp of Engineers
    - State Programmatic General Permit (SPGP) or Individual Permit (IP)
- NHDES Alteration of Terrain Permit Application (*RSA 485-A:17, Env-Wq 1500*)
- NHDES Shoreland Permit Application (*RSA 483-9, Env-Wq 1400*)
- NHDES Wetland Permit Application (*RSA 482-A, Env-Wq 100-900*)
    - Waste Management Division Review;
    - 401 Water Quality Certification Program;
    - NH Natural Heritage Bureau (NHB) Review
    - NH Division of Historical Resources (DHR) Review
    - NH Fish and Game Department (FGD) Review
    - Designated River Check and National Wetland Inventory (NWI) Check
    - Dredge Management Task Force (DMTF) Review

Time to Completion

- Permitting – one to two years depending on agency review times.
- Drawdown – 5 days for a full pond drawdown. Will need to be completed each year of dredging.
- Dredging Operations – 8.5 years to dredge the entire pond (400,000 CY). Assuming an average dredge rate of 400 CY per day and assuming dredging activities can take place 120 days per year, 48,000 CY can be dredged per year.

Estimated Total Cost

Costs of mechanical dry dredging will include the following:

- Design and permitting;
- Mobilization, equipment, and labor;
- Construction of staging areas and access/truck routes;
- Implementation of sediment/erosion controls;
- Material processing (storage, dewatering, hauling);
- Dredged material disposal/ reuse;
- Final loaming, grading, seeding.

Associated permitting costs are approximately **$100,000**.

Construction costs will vary depending on the amount of dredge material removed and disposal/reuse option implemented. Typically, for mechanical dry dredging, and associated material processing, costs range from $8 to $30 per CY of dredged material removed. Based on these prices, construction costs to dredge the entire pond (approximately 400,000 CY) are approximately **$3,200,000 - $12,000,000**.

Offsetting costs may include on-site reuse of dredged material as loam or compost, or internal hauling services, in which case a disposal or storage area would need to be identified.

3.2 Mechanical Wet Dredging

Description

Mechanical wet dredging involves the removal of sediment and plant material using standard construction equipment underwater. It is usually performed by scraping and removing sediment and plant material with a clamshell, bucket dredge, or dragline. The pond can be partially drained to a predetermined level prior to dredging to limit the flow or turbid water downstream. The dredged material is typically very wet and consists of approximately 10-30% solids. The dredged material is collected and deposited on shore, where it is staged, fully dewatered, and stored for reuse or disposal. An intermediate holding area may also be required for the dredged material because of its water content before transporting the material to be processed. Water produced from dewatering may be returned to the pond. The plant species removal is non-selective and can be performed in any season. The purpose of mechanical wet dredging is to return a pond to its pre-sedimentation conditions or increase accessible pond storage for additional water supply. Other benefits to mechanical wet dredging include controlling excessive aquatic plant and algae growth within the pond.

Feasibility/ Strengths/ Weaknesses

Mechanical wet dredging is the most effective dredging method in reducing sediment levels and plant growth in shallow areas only to increase active storage. This method is effective when the dredge material contains large obstructions. This dredging approach also typically requires the least amount of preparation and is typically the cheapest dredging approach, however, this method would may allow for proper dredging in deeper areas. Mechanical wet dredging requires less dewatering than hydraulic/pneumatic dredging, however, this method requires a partial pond drawdown, which is only feasible for a maximum duration of 3-months during the low-demand season (fall/winter/spring).

Environmental Impacts

Benefits:

- Water quality improvement;
- Enhanced pollutant trapping capabilities;
- Increased dilution of nutrient loads;
- Control rooted plant and algae growth rate;
- Removal of unwanted material in sediment;
- Long-term benefits to fisheries and wildlife habitat from water quality enhancement, aquatic plant control, and physical habitat enhancement;

Detriments:

- Temporary destruction of shallow biological habitats due to physical disturbance and partial pond drawdown;
- Potential increase in downstream turbidity due to physical disturbance and partial pond drawdown if mitigation measures are not well maintained;
- Temporary upland alteration of terrain from staging, dewatering, storage, and truck routes; and
- Potential permanent upland alteration of terrain if dredged material is reused on or off-site.

Permitting Requirements

- U.S. Army Corp of Engineers
    - State Programmatic General Permit (SPGP) or Individual Permit (IP)
- NHDES Alteration of Terrain Permit Application (*RSA 485-A:17, Env-Wq 1500*)
- NHDES Shoreland Permit Application (*RSA 483-9, Env-Wq 1400*)
- NHDES Wetland Permit Application (*RSA 482-A, Env-Wq 100-900*)
    - Waste Management Division Review;
    - 401 Water Quality Certification Program;
    - NH Natural Heritage Bureau (NHB) Review
    - NH Division of Historical Resources (DHR) Review
    - NH Fish and Game Department (FGD) Review
    - Designated River Check and National Wetland Inventory (NWI) Check
    - Dredge Management Task Force (DMTF) Review

Time to Completion

- Permitting – one to two years depending on agency review times.
- Drawdown – 2-3 days for a partial pond drawdown. Will need to be completed each year of dredging.
- Dredging Operations – 8.5 years to dredge the entire pond (400,000 CY). Assuming an average dredge rate of 400 CY per day and assuming dredging activities can take place 120 days per year, 48,000 CY can be dredged per year.

Estimated Total Cost

Costs of mechanical dry dredging will include the following:

- Design and permitting;
- Mobilization, equipment, and labor;
- Construction of staging areas and access/truck routes;
- Implementation of sediment/erosion controls;
- Material processing (storage, dewatering, hauling);
- Dredged material disposal/ reuse;
- Final loaming, grading, seeding.

Associated permitting costs are approximately **$100,000**.

Construction costs will vary depending on the amount of dredge material removed and disposal/reuse option implemented. Typically, for mechanical wet dredging, and associated material processing, costs range from $15 to $25 per CY of dredged material removed. Based on these prices, construction costs to dredge the entire pond (approximately 400,000 CY) are approximately **$6,000,000 - $10,000,000**.

Offsetting costs may include on-site reuse of dredged material as loam or compost, or internal hauling services, in which case a disposal or storage area would need to be identified.

3.3 Hydraulic or Pneumatic Dredging

Description

Hydraulic or pneumatic dredging utilizes machinery to excavate sediment and plant material from areas under water. It is a more advanced form of wet dredging where the sediment debris is agitated and then vacuumed out through a pipeline to the collection area from a floating structure or a barge. Hydraulic dredging is performed by a suction dredge that has a cutter head. Pneumatic dredging is used for sediments with higher solid contents where air pressure is used to pump the sediments out of the lake. A barge with a suction line is used to suck out the plants and sediment to a specific depth. The lake does not need to be dewatered before employing either method but should be performed during the summer months to avoid any freezing of the pump systems. The dredged material is typically very wet and consists of approximately 10-20% solids. The dredged material is collected and deposited on shore, where it is staged, fully dewatered, and stored for reuse or disposal. An intermediate holding area may also be required for the dredged material because of its water content before transporting the material to be processed. Water produced from dewatering may be returned to the pond. The plant species removal is non-selective and can be performed in any season. The purpose of hydraulic or pneumatic dredging is to return a pond to its pre-sedimentation conditions or increase accessible pond storage for additional water supply. Other benefits to mechanical wet dredging include controlling excessive aquatic plant and algae growth within the pond.

Feasibility/ Strengths/ Weaknesses

Hydraulic or pneumatic dredging is the most effective dredging method in reducing sediment levels and plant growth in deep areas to increase active storage. This method is not effective when the dredge material contains large obstructions. Unlike mechanical dry or wet dredging, hydraulic or pneumatic dredging does not require a pond drawdown, which reduces turbidity, impacts on shallow organic habitats, and time of year restrictions. This approach, however, requires the most dewatering and more sophisticated, expensive equipment.

Environmental Impacts

Benefits:

- Water quality improvement;
- Enhanced pollutant trapping capabilities;
- Increased dilution of nutrient loads;
- Control rooted plant and algae growth rate;
- Removal of unwanted material in sediment;
- Larger depth gradients and opportunities for habitat diversity; and,
- Long-term benefits to fisheries and wildlife habitat from water quality enhancement, aquatic plant control, and physical habitat enhancement;

Detriments:

- Temporary upland alteration of terrain from staging, dewatering, storage, and truck routes; and
- Potential permanent upland alteration of terrain if dredged material is reused on or off-site.

Permitting Requirements

- U.S. Army Corp of Engineers
    - State Programmatic General Permit (SPGP) or Individual Permit (IP)
- NHDES Alteration of Terrain Permit Application (*RSA 485-A:17, Env-Wq 1500*)
- NHDES Shoreland Permit Application (*RSA 483-9, Env-Wq 1400*)
- NHDES Wetland Permit Application (*RSA 482-A, Env-Wq 100-900*)
    - Waste Management Division Review;
    - 401 Water Quality Certification Program;
    - NH Natural Heritage Bureau (NHB) Review
    - NH Division of Historical Resources (DHR) Review
    - NH Fish and Game Department (FGD) Review
    - Designated River Check and National Wetland Inventory (NWI) Check
    - Dredge Management Task Force (DMTF) Review

Time to Completion

- Permitting – one to two years depending on agency review times.
- Dredging Operations – 8.5 years to dredge the entire pond (400,000 CY). Assuming an average dredge rate of 400 CY per day and assuming dredging activities can take place 120 days per year, 48,000 CY can be dredged per year.

Estimated Total Cost

Costs of mechanical dry dredging will include the following:

- Design and permitting;
- Mobilization, equipment, and labor;
- Construction of staging areas and access/truck routes;
- Implementation of sediment/erosion controls;
- Material processing (storage, dewatering, hauling);
- Dredged material disposal/ reuse;
- Final loaming, grading, seeding.

Associated permitting costs are approximately **$100,000**.

Construction costs will vary depending on the amount of dredge material removed and disposal/reuse option implemented. Typically, for hydraulic or pneumatic dredging, and associated material processing, costs range from $7 to $30 per CY of dredged material removed. Based on these prices, construction costs to dredge the entire pond (approximately 400,000 CY) are approximately **$2,800,000 - $12,000,000**.

Offsetting costs may include on-site reuse of dredged material as loam or compost, or internal hauling services, in which case a disposal or storage area would need to be identified.

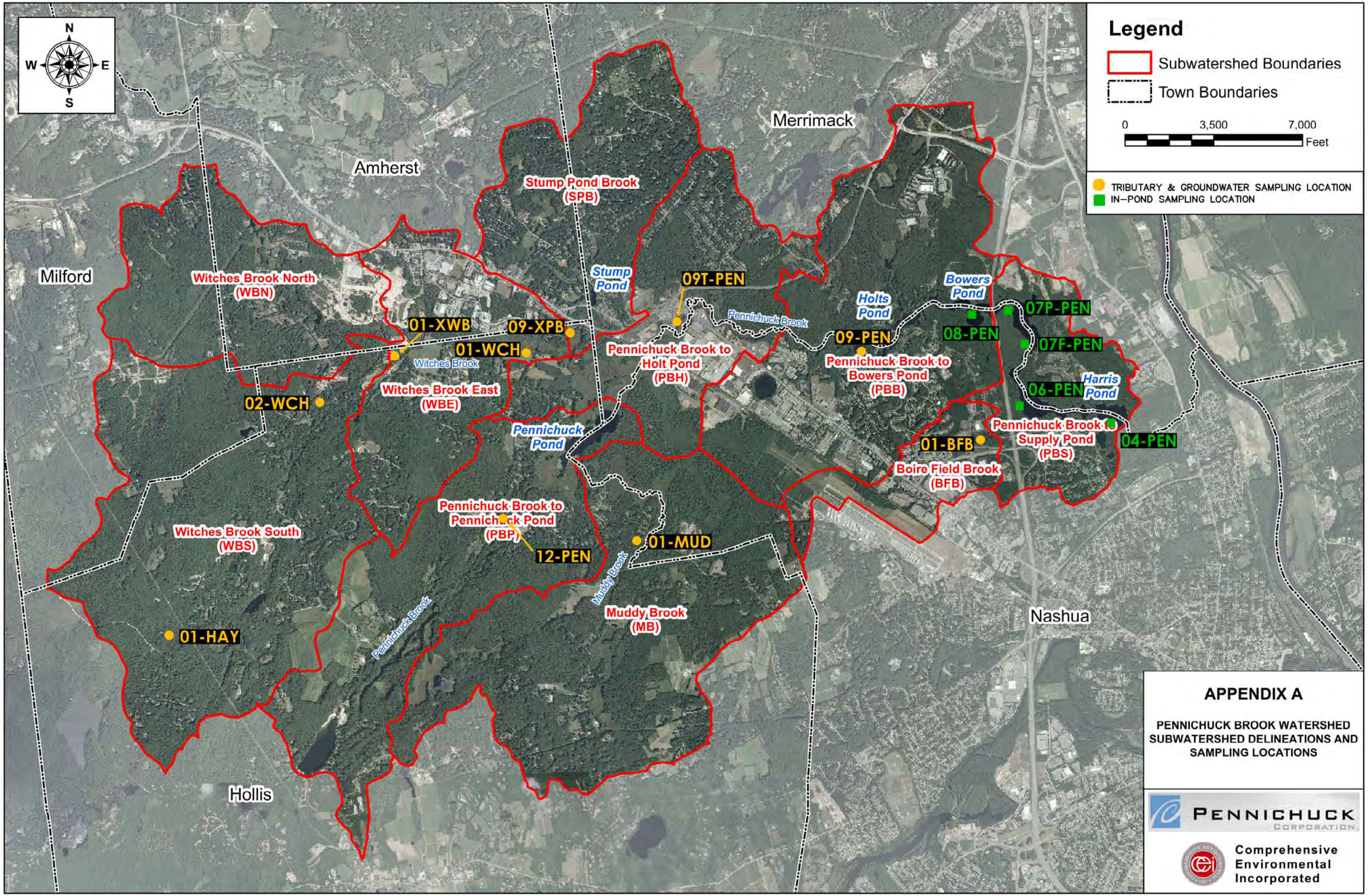
4.0 Priority Dredging Areas and Recommendations

The hydraulic/pneumatic dredging alternative was chosen as the most viable dredge method based on the volume of dredge material, dredging depths, and dredge material characteristics. Due to the immense volume of dredge material, dredging operations would last over eight years (to dredge maximum of 400,000 CY and gain maximum 8 days of supply). Hydraulic/pneumatic dredging does not require a drawdown; it will not be feasible to permit and carry out a full or partial pond drawdown each year. Hydraulic/pneumatic dredging would also be effective at the proposed depths (20' feet for Upper Harris Pond and 26' for Lower Harris Pond). Additionally, with the exception of the first four feet of organic material across the pond bottom, the deeper of the dredge material consists of sand or silty sand which will drain quickly, reducing the time to dewater the dredged material.

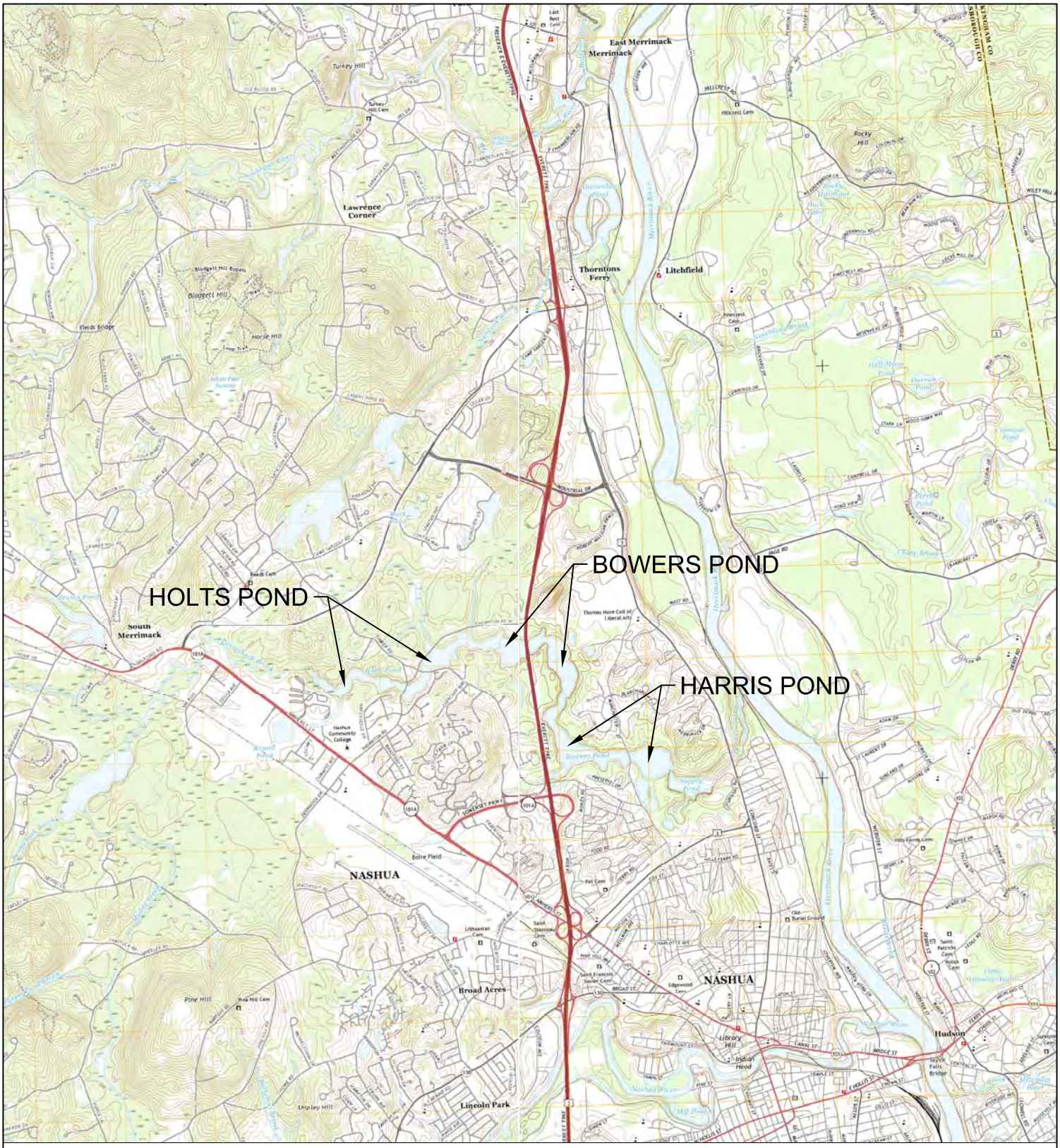
Site access for hydraulic/dredging operations can occur through one entry point to Harris Pond, since the dredging equipment will be on a floating structure or barge. Access routes to the pond includes Manchester Street and the existing PWW maintenance road to Harris Pond Dam. Staging, dewatering, and storage areas will also be positioned along the access route for convenient loading and hauling activities; there is a 270,000 SF area bordering Manchester Street and the existing PWW maintenance road outside of the 200' shoreline buffer and on PWW-owned property. Assuming 48,000 CY (1,296,000 CF) of dredge material will be produced per year and assuming 60-80% volume reduction after dewatering, the yearly stockpile will be 260,000 CF to 520,000 CF. Therefore, a 10-ft tall stockpile would only encompass 26,000 to 52,000 SF of this area.

Refer to the figure in **Appendix H** for a summary table and figure of the four hydraulic dredging options (see Section 2.5). The table and figure includes a summary of potential storage gained (million gallons and days), costs, cost per storage gained, expected permitting requirements, engineering/construction considerations, and time to completion. Engineering and construction considerations includes a breakdown of the expected volume of dredged material, sampling protocol, and disposal/reuse options; the figure shows locations of potential access routes and staging/dewatering/storage areas. <u>Based on this analysis, option 1c or 1d are recommended if dredging is chosen as a method to increase storage in Harris Pond.</u>

Appendix A
Pennichuck Brook Watershed Map


N
W
E
S
Legend
Subwatershed Boundaries
Town Boundaries
0
3,500
7,000
Feet
TRIBUTARY & GROUNDWATER SAMPLING LOCATION
IN-POND SAMPLING LOCATION
Merrimack
Amherst
Milford
Nashua
Hollis
Stump Pond Brook (SPB)
Stump Pond
Witches Brook North (WBN)
09T-PEN
Pennichuck Brook
Holts Pond
Bowers Pond
07P-PEN
08-PEN
07F-PEN
01-XWB
09-XPB
01-WCH
Witches Brook
09-PEN
Pennichuck Brook to Holt Pond (PBH)
Pennichuck Brook to Bowers Pond (PBB)
06-PEN
Harris Pond
02-WCH
Witches Brook East (WBE)
Pennichuck Pond
Pennichuck Brook to Supply Pond (PBS)
04-PEN
01-BFB
Boire Field Brook (BFB)
Pennichuck Brook to Pennichuck Pond (PBP)
12-PEN
01-MUD
Witches Brook South (WBS)
Muddy Brook
Muddy Brook (MB)
01-HAY
Pennichuck Brook
APPENDIX A
PENNICHUCK BROOK WATERSHED SUBWATERSHED DELINEATIONS AND SAMPLING LOCATIONS
PENNICHUCK CORPORATION
Comprehensive Environmental Incorporated

Appendix B
USGS Topographic Map



TOWNS OF NASHUA AND MERRIMACK, NH

HARRIS POND DREDGE STUDY

USGS Locus Map

N
W E
S

5000 0 5000 10000

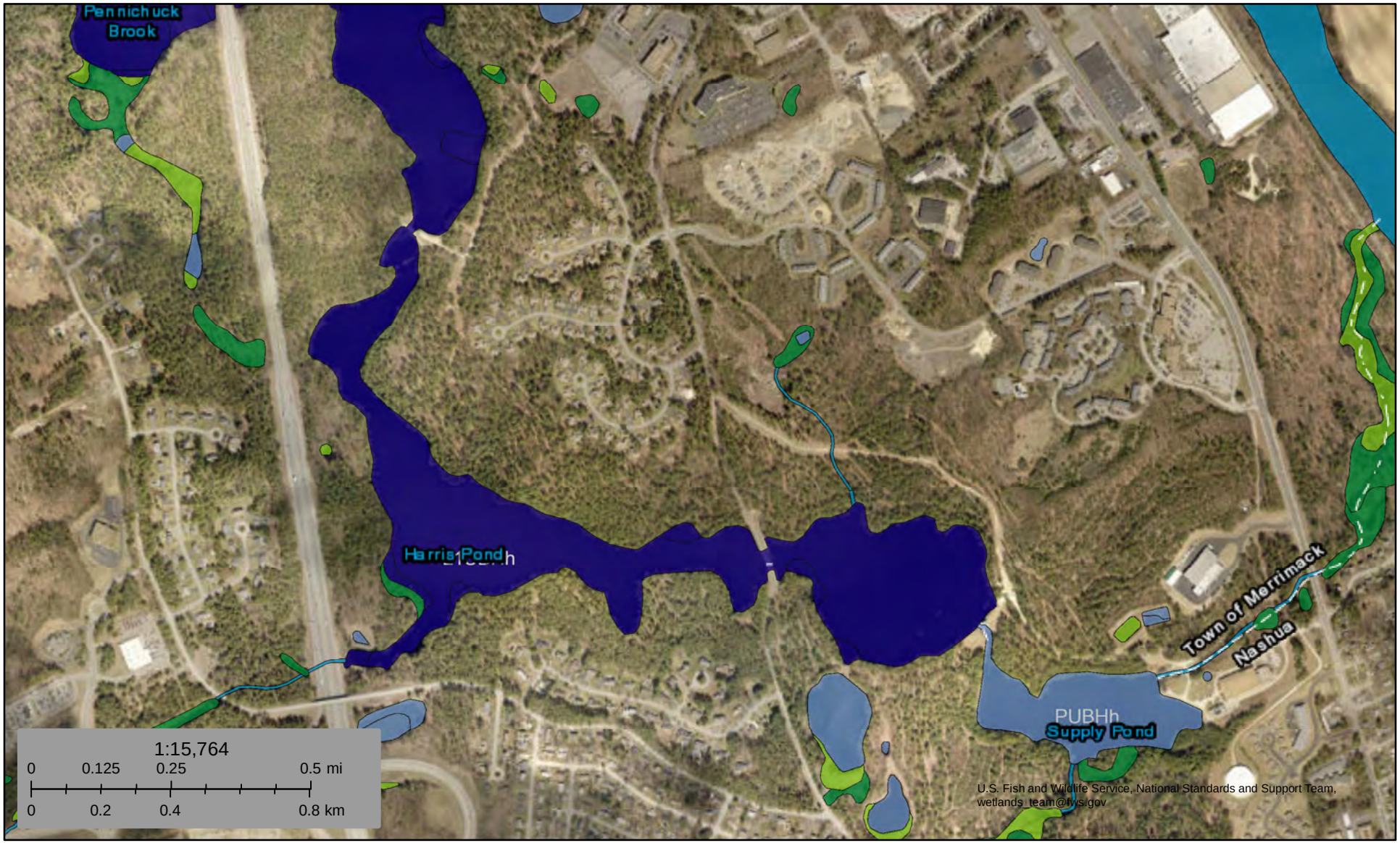
LOCUS SCALE 1" = 5000'

Comprehensive Environmental Incorporated

Appendix C
Harris Pond National Wetlands Inventory Map

U.S. Fish and Wildlife Service
National Wetlands Inventory

Harris Pond NWI Map



January 7, 2019

Wetlands

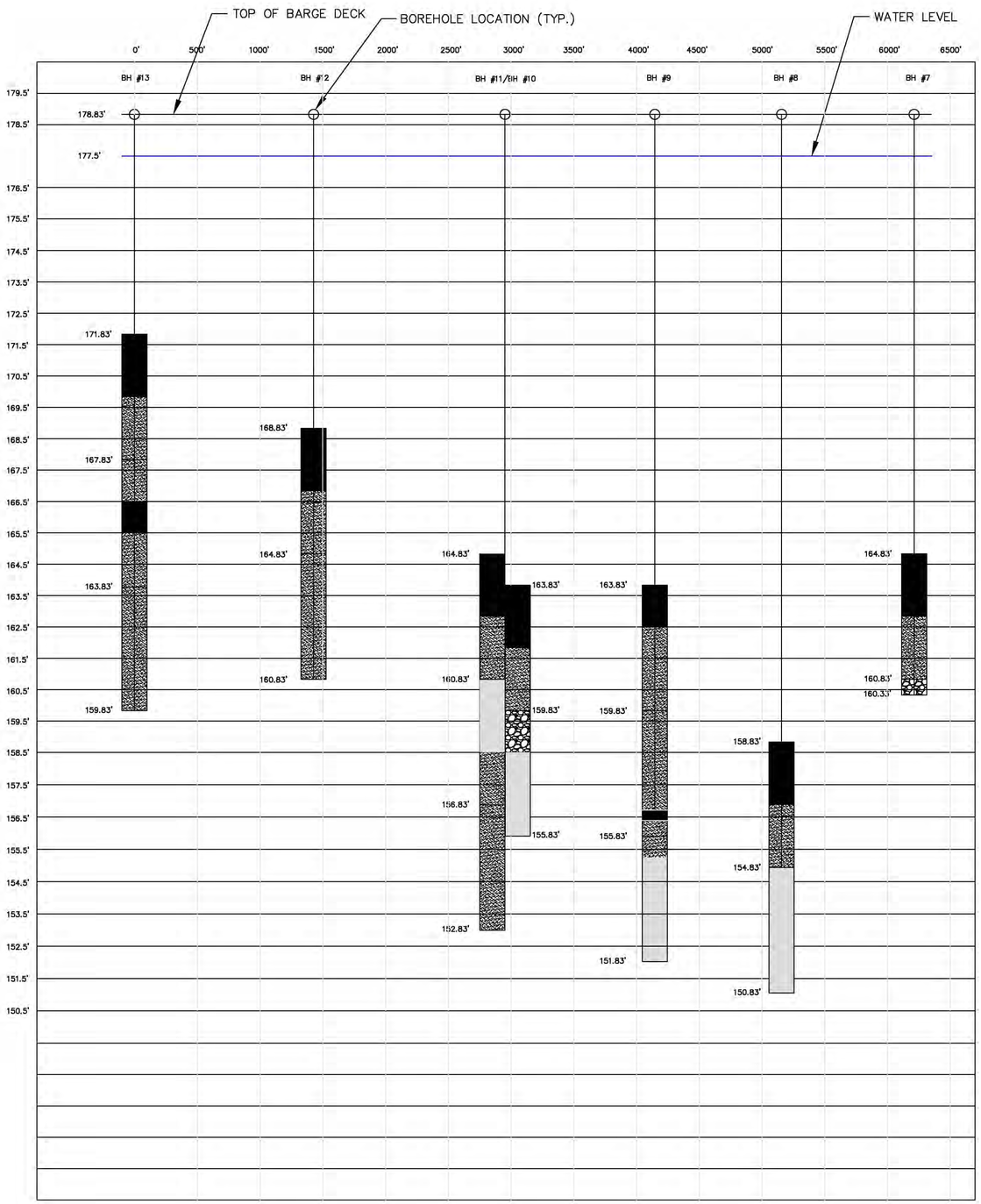
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

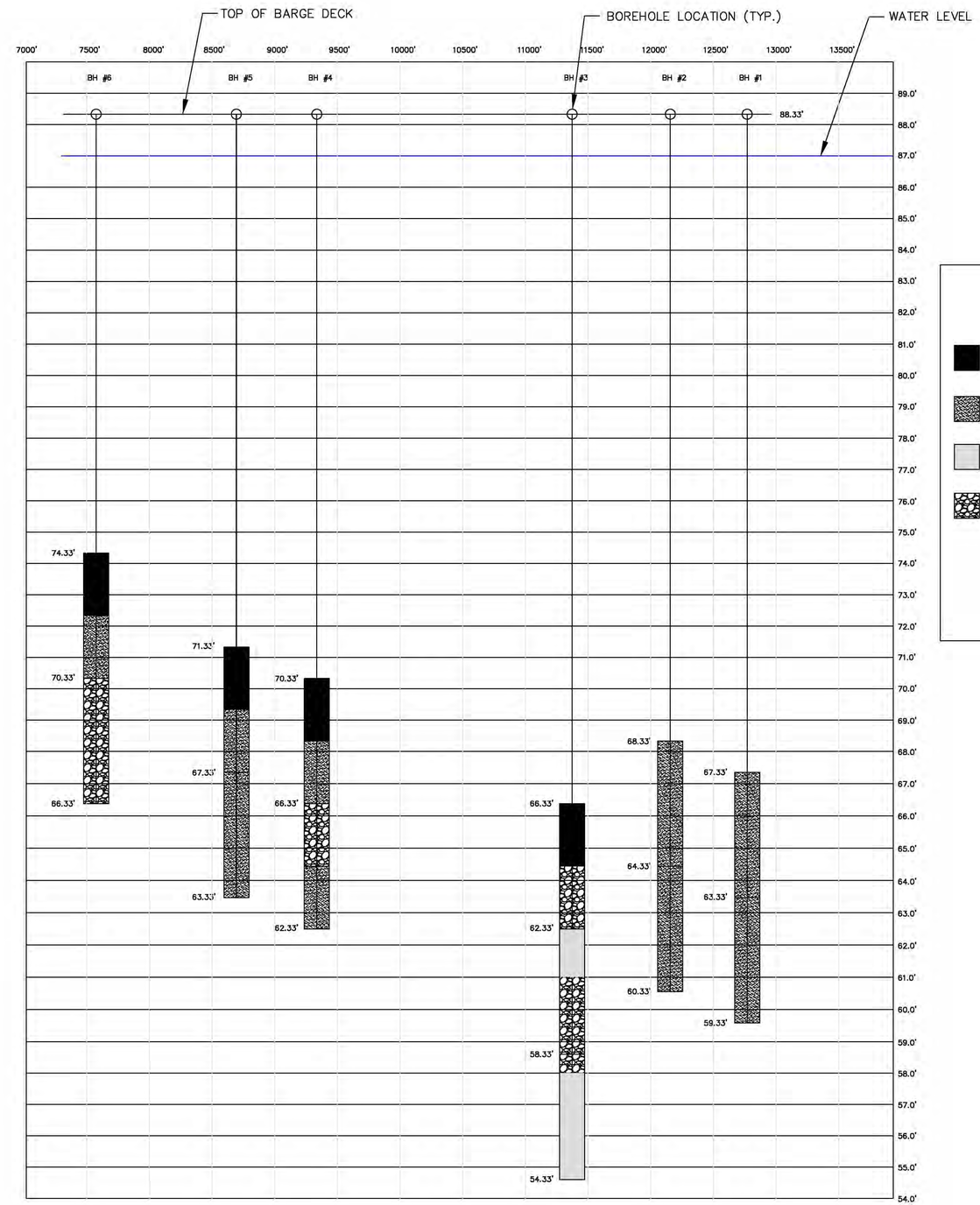
This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

Appendix D
Boring Core Logs, Profiles, Locations

Figure 1:
Pennichuck Water Supply
Sediment Measurements
Legend
Sediment Core Location
0 500 1,000 1,500 2,000
Feet
N
W
E
S
THORNTON ROAD
Bowers Pond
TB-12
TB-10
TB-11
TB-13
TB-9
TB-8
Bowers Pond
TB-7
Holts Pond
STUART DRIVE
TINKER ROAD
Bowers Pond Dam
MANCHESTER STREET
DANIEL WEBSTER HWY
TB-6
Harris Pond
TB-5
Pennichuck Brook
Harris Pond
TB-4
TB-3
TB-2
TB-1
Harris Pond Dam
Supply Pond
AMHERST STREET
THORNTON ROAD
F.E. EVERETT TPK
TINKER ROAD





LEGEND

- ORGANIC MATERIAL
- SANDY MATERIAL
- SILTY/MUDDY MATERIAL
- SEDIMENT/GRAVEL

BOWERS POND
ELEVATION=177.5'

VERTICAL SCALE

1" = 2' 0 2 4 6
SCALE FEET

HORIZONTAL SCALE

1" = 500' 0 500 1000 1500
SCALE FEET

HARRIS POND
ELEVATION=90.5'

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-1
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Harris Pond
	DATE: 10/4/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15					
	20					
			sand/minimal organic material (all pine; no leaves)			sample recovery: ≈1.25'
	25		very solid sand/minimal organic material			sample recovery: ≈2.31'
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-2
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Harris Pond
	DATE: 10/4/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Water Surface			
	20		sand/minimal organic material			sample recovery: ≈1.25'
	25		solid sand			sample recovery: ≈2.19'

0 5 10 15 20 25 30 35 40

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-3
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Harris Pond
	DATE: 10/4/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15					
	20					
	25		soft/some organics to hard sediment			sample recovery: ≈0.69'
	30		slight organic material (soft) to sediment (hard)			sample recovery: ≈1.00'
	35		very solid sediment to silt			sample recovery: ≈0.69'
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-4
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Harris Pond
	DATE: 10/5/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15					
	20		Little silt, sandy, soft organic sand			sample recovery: ≈0.65'
	25		sediment to sand/minimal organic material			sample recovery: ≈1.44'
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-5
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Harris Pond
	DATE: 10/5/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15					
	20		organic material to sand			sample recovery: ≈1.35'
	25		good sand/some organic bands			sample recovery: ≈2.27'
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-6
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Harris Pond
	DATE: 10/5/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15		organic/dark brown sand			sample recovery: ≈1.35'
	20		sandy gravel (hard); river bottom cobble			sample recovery: ≈0.52'
	25					
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-7
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/9/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15		light silt to solid sand			sample recovery: ≈0.58'
			no recovery-river bottom			none
	20					
	25					
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-8
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/9/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15					
	20		soft silt into soft sand			sample recovery: ≈1.77'
	25		soft dark silt to grey silt			sample recovery: ≈2.04'
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-9
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/9/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15		soft/dark silt to soft sand			sample recovery: ≈2.06'
	20		sand into soft silt/some organic bands			sample recovery: ≈2.17'
	25		soft silt to hard gravel at 26'			sample recovery: ≈2.13'
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-10
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/9/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15		soft dark organic material to soft sand			sample recovery: ≈1.29'
	20		gravel to silty sand			sample recovery: ≈1.17'
	25					
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-11
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/10/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10					
	15		soft/dark organic material to soft sand			sample recovery: ≈2.06'
	20		silty sand to soft sand			sample recovery: ≈1.08'
	25		soft sand			sample recovery: ≈1.23'
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-12
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/10/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10		soft/dark organic material to soft sand			sample recovery: ≈1.48'
	15		soft sand			sample recovery: ≈2.46'
	20					
	25					
	30					
	35					
	40					

Sediment Core Boring Log

Comprehensive Environmental
Incorprated
21 Depot Street
Merrimack, NH 03054

PROJECT:	BORING/TP: TB-13
Pennichuck Water Works-Pond Sediment Borings	LOCATION: Bowers Pond
	DATE: 10/10/2012 SCALE: 1 inc = 0.5"

ELEV	Depth	Symbol	Description of Materials	BPF	WL	Remarks
0	0	GS	Ground Surface			
	5					
	10		soft dark silt to soft sand			sample recovery: ≈1.54'
	15		soft sand with organic bands			sample recovery: ≈1.52'
			soft sand			sample recovery: ≈2.15'
	20					
	25					
	30					
	35					
	40					

Appendix E
Soil Gradation Test Results

S.W.COLE ENGINEERING, INC.

LETTER OF TRANSMITTAL

Project Name Merrimack NH - Pennichuck Source Testing

Project Number 13-0019

Project Manager Scott Harmon

Client Comprehensive Environmental, Inc,

Date 1/9/2013

Comprehensive Environmental, Inc,
William Devore
21 Depot Street
Merrimack, NH 03054

Phone 603-424-8444

Results Being Reported

GRAIN SIZE (WET SIEVE) - ASTM C117, C136/AASHTO T11, T27

Copy To

Notes:

S. W. COLE ENGINEERING, INC.

BY:

S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

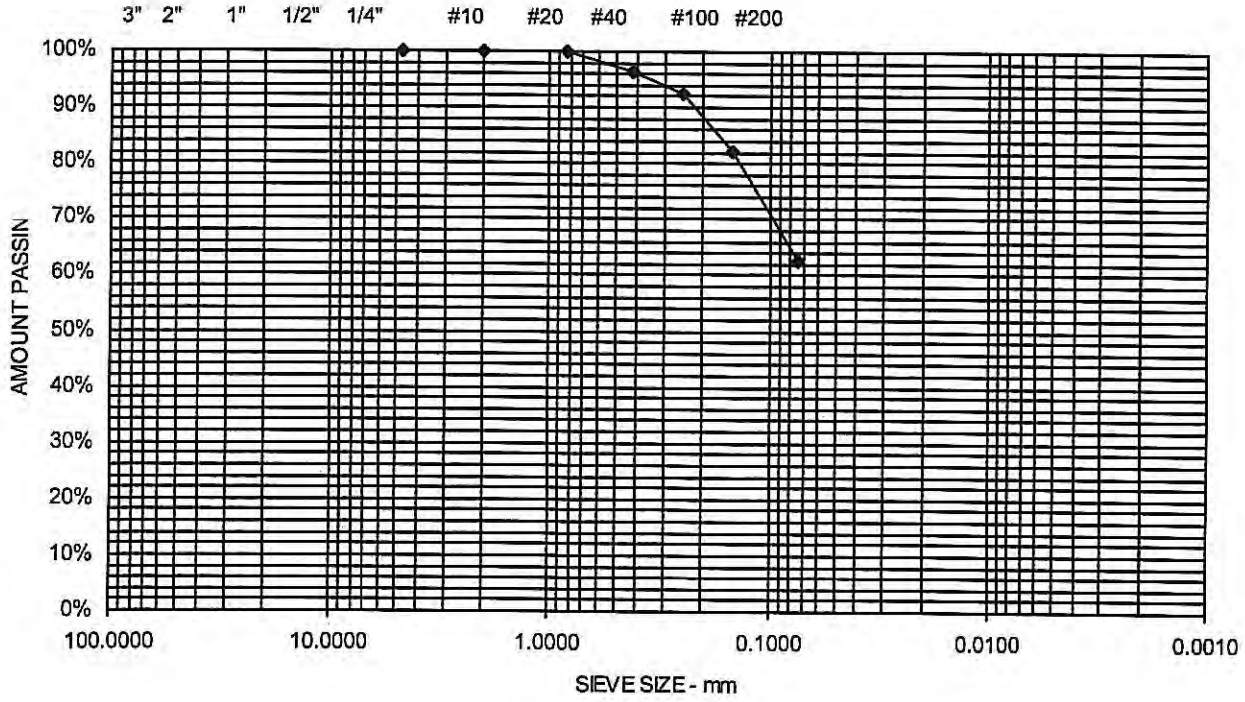
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-1**

Project Number 13-0019
Lab ID 108M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	No. 4	100	0% Gravel
2.00 mm	No. 10	100	
850 um	No. 20	100	
425 um	No. 40	97	37.4% Sand
250 um	No. 60	92	
150 um	No. 100	82	
75 um	No. 200	62.6	62.6% Fines

SANDY SILT



Comments:

Sheet

S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

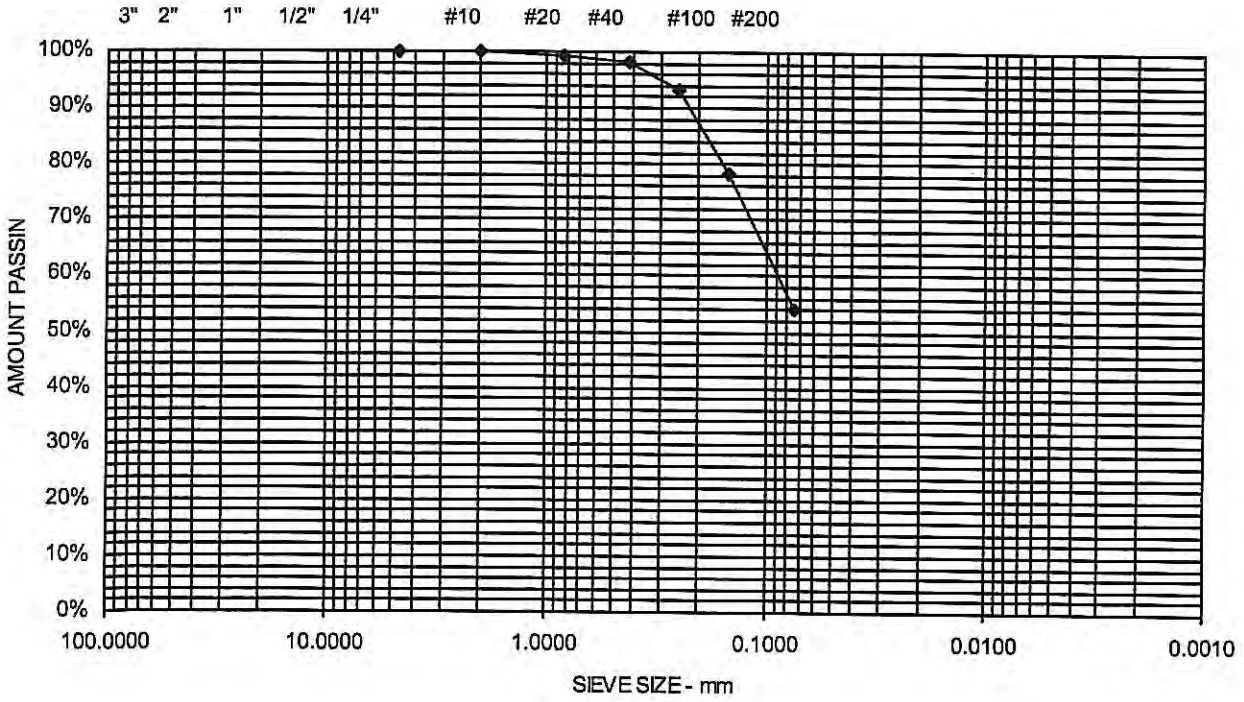
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-2**

Project Number 13-0019
Lab ID 109M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/um)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	**No. 4**	**100**	0% Gravel
2.00 mm	**No. 10**	**100**	
850 um	**No. 20**	**99**	
425 um	**No. 40**	**98**	45.9% Sand
250 um	**No. 60**	**93**	
150 um	**No. 100**	**78**	
75 um	**No. 200**	**54.1**	54.1% Fines

SANDY SILT



Comments:

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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

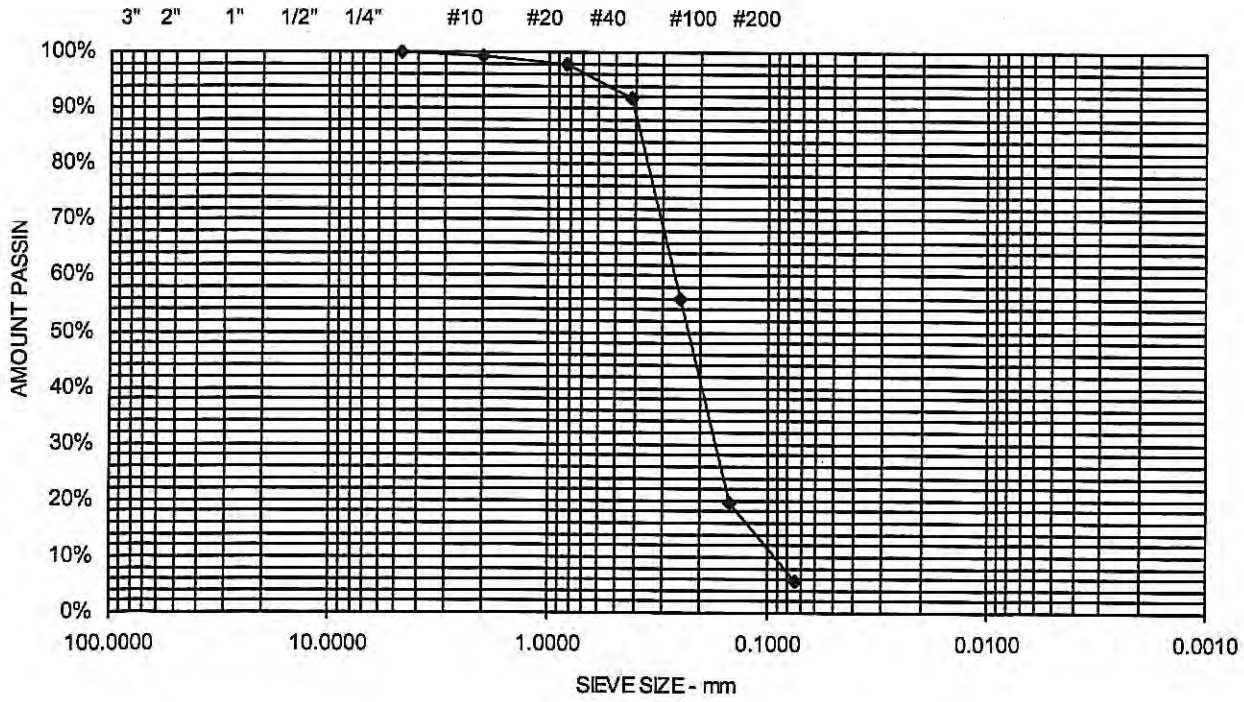
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-3**

Project Number 13-0019
Lab ID 110M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/um)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	No. 4	100	0% Gravel
2.00 mm	No. 10	99	
850 um	No. 20	98	
425 um	No. 40	92	94.5% Sand
250 um	No. 60	56	
150 um	No. 100	20	
75 um	No. 200	5.5	5.5% Fines

MEDIUM TO FINE SAND



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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

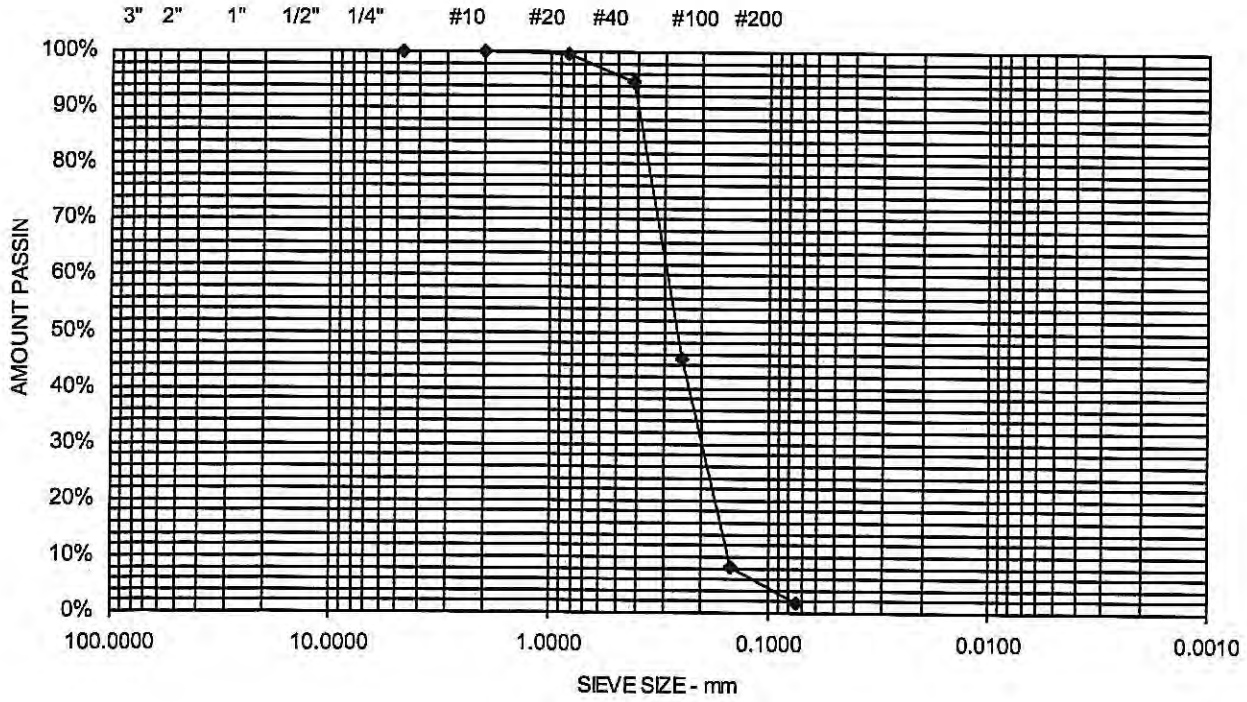
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-4**

Project Number 13-0019
Lab ID 111M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	No. 4	100	0% Gravel
2.00 mm	No. 10	100	
850 um	No. 20	100	
425 um	No. 40	95	98.1% Sand
250 um	No. 60	45	
150 um	No. 100	8	
75 um	No. 200	1.9	1.9% Fines

FINE MEDIUM SAND



Comments:

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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

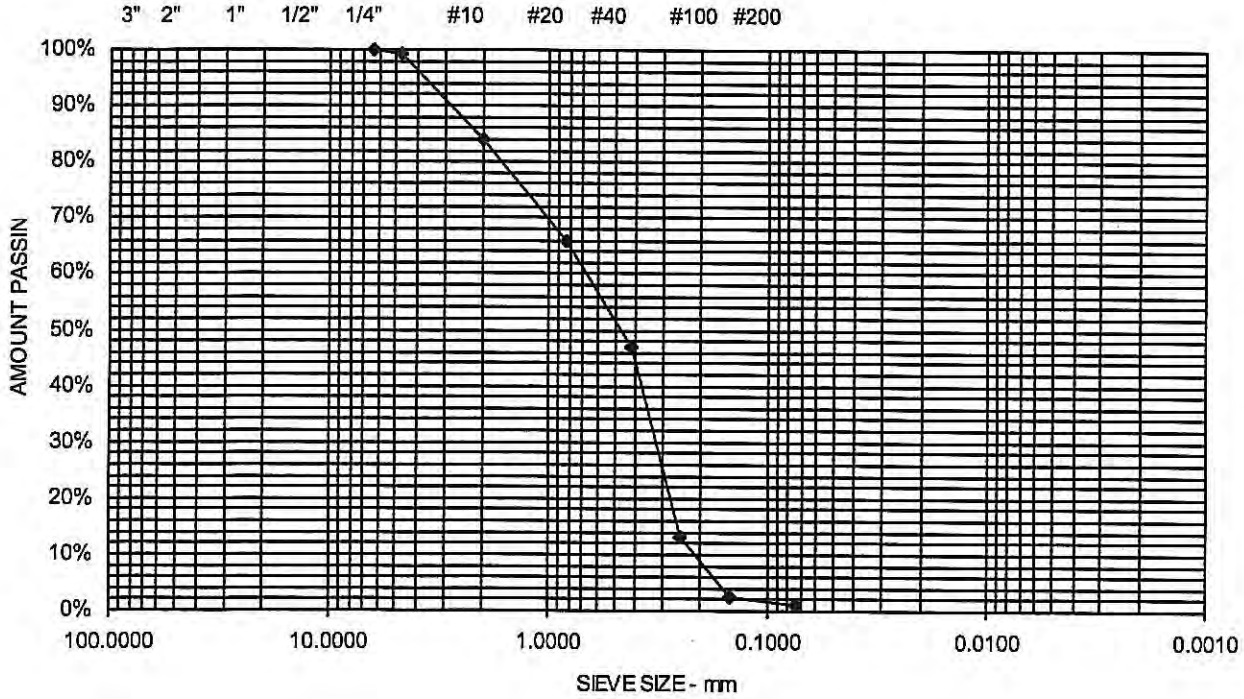
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-5**

Project Number 13-0019
Lab ID 112M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
6.3 mm	1/4"	100	
4.75 mm	No. 4	99	0.7% Gravel
2.00 mm	No. 10	84	
850 um	No. 20	66	
425 um	No. 40	47	98.3% Sand
250 um	No. 60	13	
150 um	No. 100	2	
75 um	No. 200	1.0	1% Fines

COARSE TO MEDIUM SAND



Comments:

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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

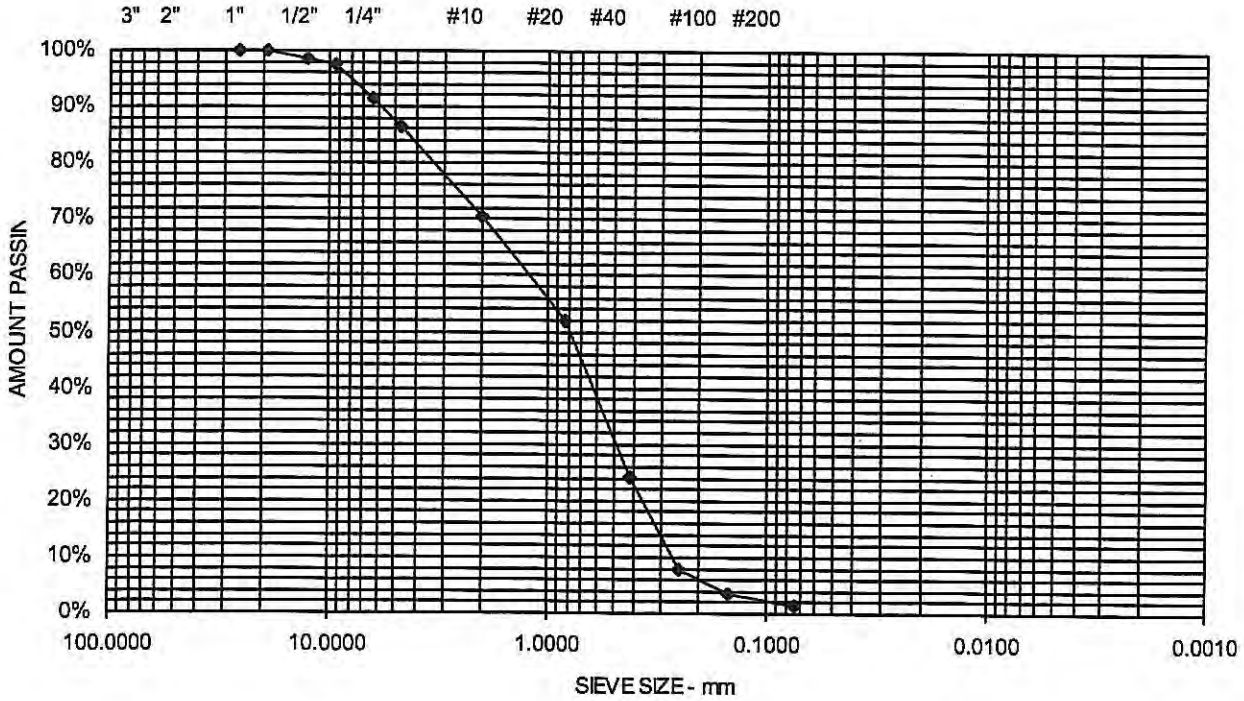
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-6**

Project Number 13-0019
Lab ID 113M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
25.0 mm	1"	100	
19.0 mm	3/4"	100	
12.5 mm	1/2"	99	
9.5 mm	3/8"	98	
6.3 mm	1/4"	92	
4.75 mm	No. 4	86	13.5% Gravel
2.00 mm	No. 10	70	
850 um	No. 20	52	
425 um	No. 40	24	85.1% Sand
250 um	No. 60	8	
150 um	No. 100	3	
75 um	No. 200	1.3	1.3% Fines

SAND WITH LITTLE FINE GRAVEL



Comments:

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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

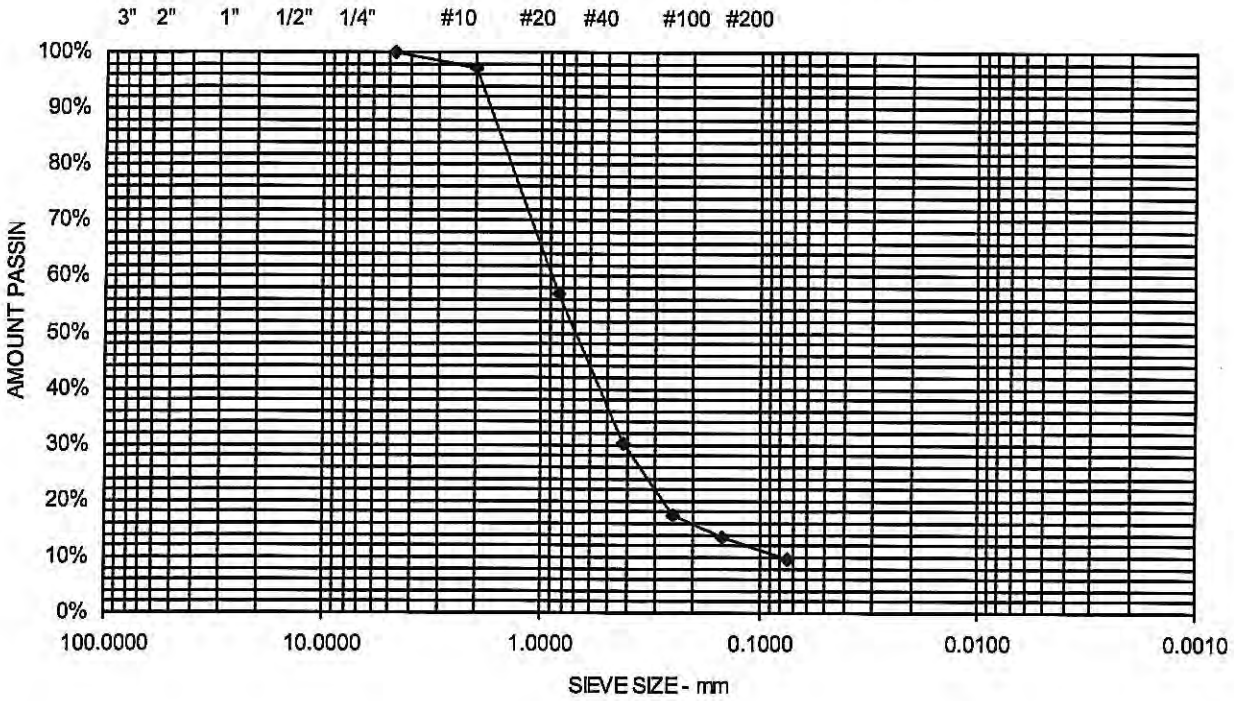
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-7**

Project Number 13-0019
Lab ID 114M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	**No. 4**	**100**	0% Gravel
2.00 mm	**No. 10**	**97**	
850 um	**No. 20**	**57**	
425 um	**No. 40**	**30**	90.6% Sand
250 um	**No. 60**	**17**	
150 um	**No. 100**	**13**	
75 um	**No. 200**	**9.4**	9.4% Fines

FINE TO MEDIUM SAND WITH LITTLE SILT



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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

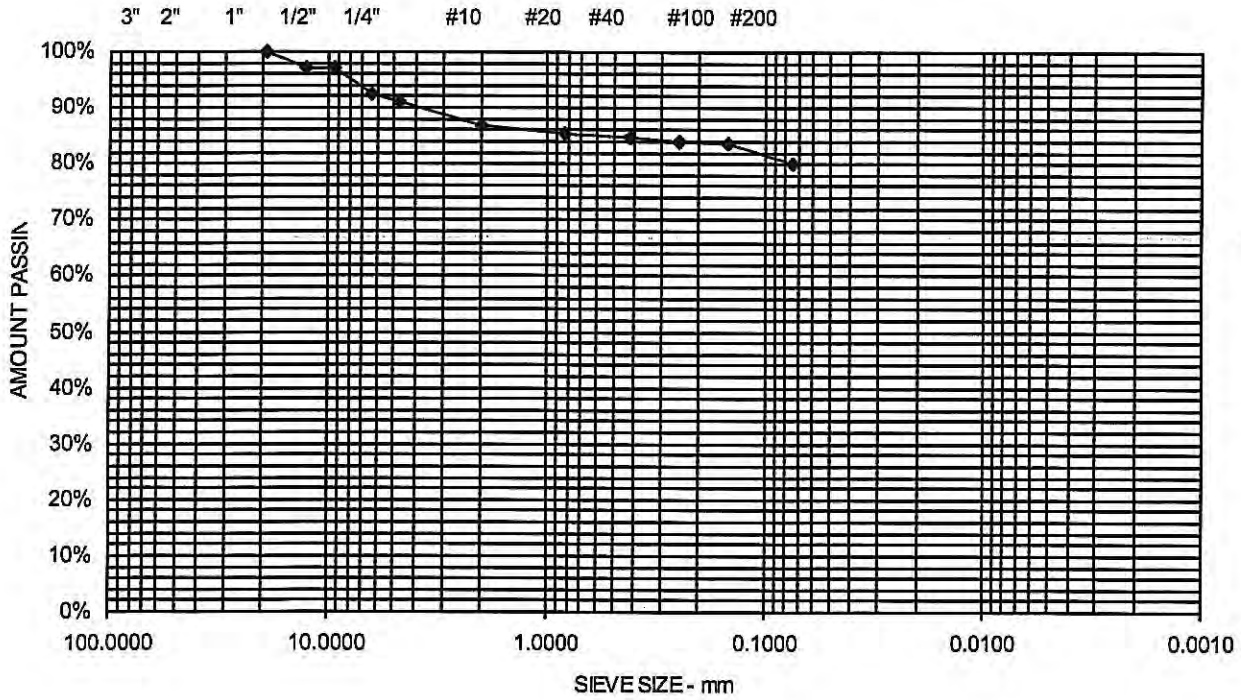
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-8**

Project Number 13-0019
Lab ID 115M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/um)	SIEVE SIZE	AMOUNT PASSING (%)	
19.0 mm	3/4"	100	
12.5 mm	1/2"	97	
9.5 mm	3/8"	97	
6.3 mm	1/4"	93	
4.75 mm	No. 4	91	9% Gravel
2.00 mm	No. 10	87	
850 um	No. 20	85	
425 um	No. 40	85	11% Sand
250 um	No. 60	84	
150 um	No. 100	84	
75 um	No. 200	80.0	80% Fines

SILT AND CLAY WITH SAND AND FINE GRAVEL



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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

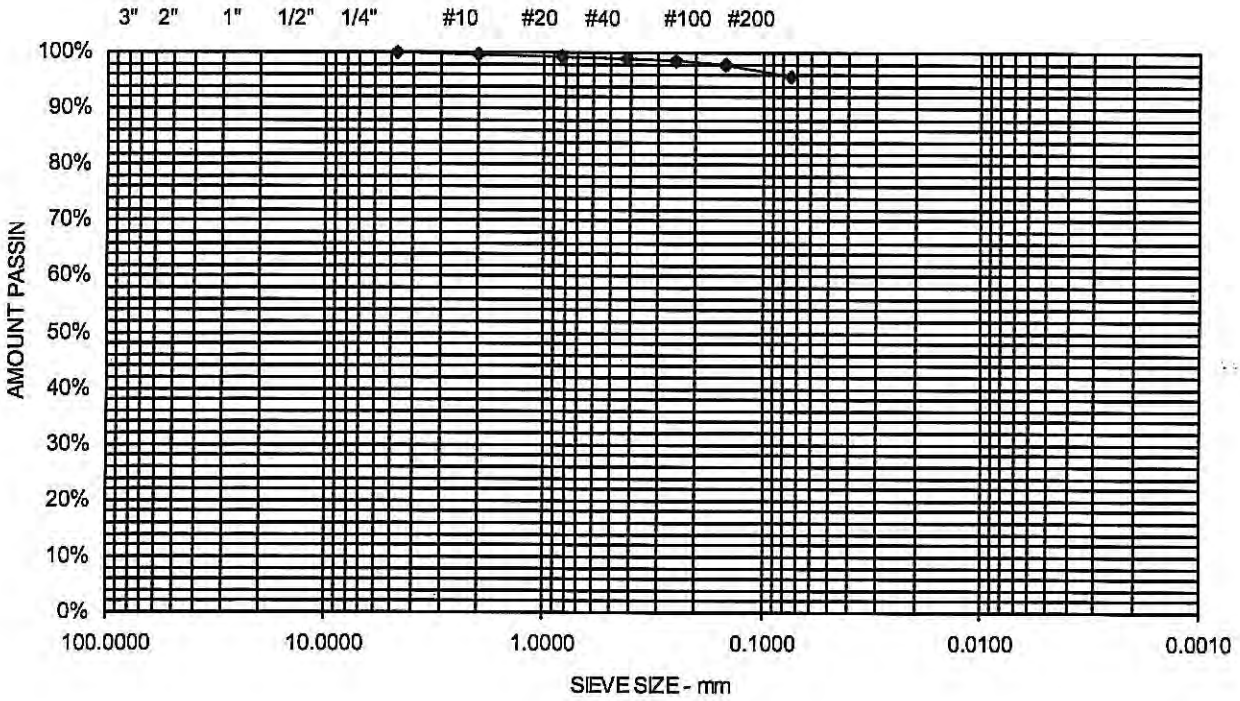
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-9**

Project Number 13-0019
Lab ID 116M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	No. 4	100	0% Gravel
2.00 mm	No. 10	100	
850 um	No. 20	99	
425 um	No. 40	99	4.2% Sand
250 um	No. 60	98	
150 um	No. 100	98	
75 um	No. 200	95.8	95.8% Fines

SILT AND CLAY



Comments:

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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

Project Name MERRIMACK NH - PENNICHUCK SOURCE TESTING

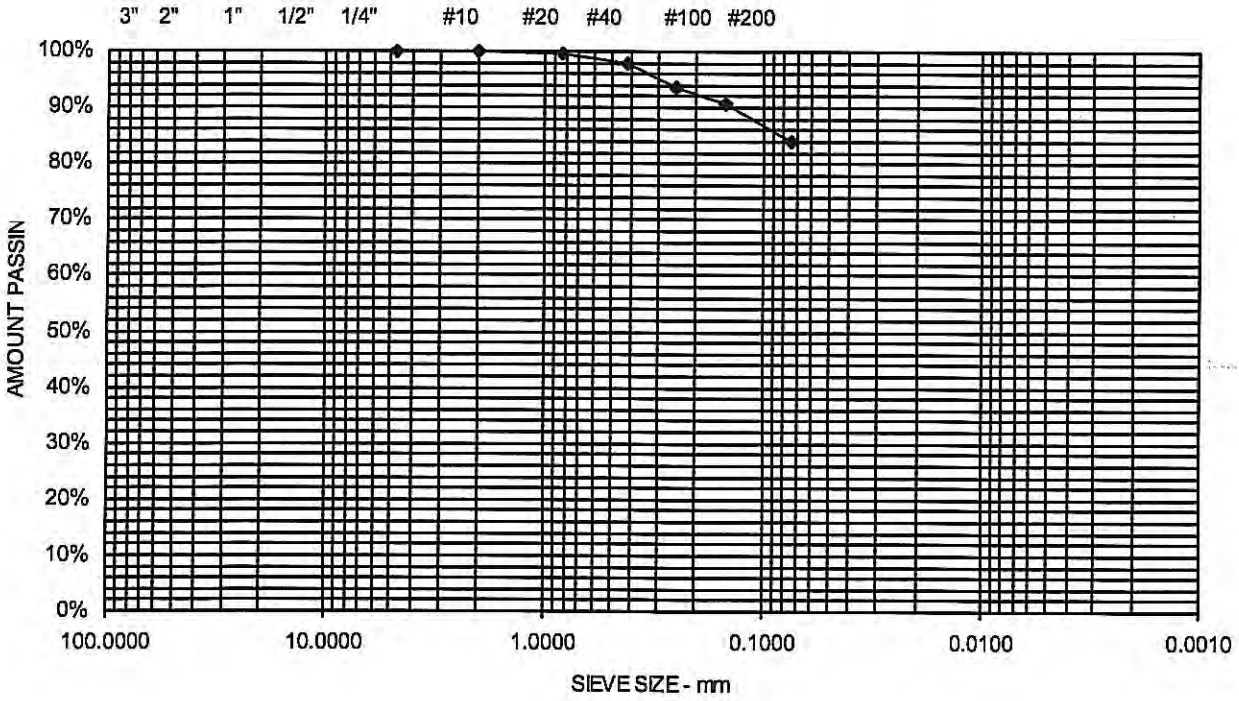
Client COMPREHENSIVE ENVIRONMENTAL, INC,

Material Source **S-10**

Project Number 13-0019
Lab ID 117M
Date Received 1/8/2013
Date Completed 1/9/2013
Tested By CHRISTOPHER WILDES

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
4.75 mm	No. 4	100	0% Gravel
2.00 mm	No. 10	100	
850 um	No. 20	100	
425 um	No. 40	98	16% Sand
250 um	No. 60	94	
150 um	No. 100	91	
75 um	No. 200	84.0	84% Fines

SILT AND CLAY WITH FINE SAND



Comments:

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Appendix F
Soil Lab Results

317 Elm Street
Milford, NH 03055

(603) 673-5440
Fax (603) 673-0366
Sales@chemservelab.com

Wednesday, August 29, 2018
Ben Lundsted
Comprehensive Environmental Inc.
21 Depot St
Merrimack NH 03054

Project Name: Harris Pond Dredging
Project #: 131-65
Project Location: Harris Pond, Nashua NH
Control #: 111792

Lab ID: 18080245
Date Received: 8/14/2018

Dear Ben Lundsted

Enclosed please find the laboratory results for the above referenced samples that were received by the ChemServe sample custodian on the above referenced date. Any abnormalities to the samples upon receipt would be noted on the enclosed chain of custody document. This report is not valid without a completed chain of custody with the corresponding control number, attached.

All samples analyzed by ChemServe are subject to quality standards. These standards are as stringent or more stringent than those established under NELAC, 40 CFR Part 136, state certification programs, and corresponding methodologies. ChemServe has a written QA/QC Procedures Manual that outlines these standards, and is available for your reference, upon request. Unless otherwise stated on the Chain of Custody or within the report, all holding times, preservation techniques, container types, and analytical methods are analogous with those outlined by NELAC. All units are based on “as received” weight unless denoted “dry”.

Residual chlorine, sulfite and pH are intended to be performed as an immediate field analysis. Should any of these analyses be performed in the lab instead of in the field it will result in those analyses being performed out of holding time.

I certify that I have reviewed the above referenced analytical data and state forms, and I have found this report within compliance with the procedures outlined within NELAC. ChemServe’s certified parameter list can be found at http://www.chemservelab.com/Laboratory-Information-and-Documentation.aspx

Jay Chrystal - President/Laboratory Director

Certificate Number 1008

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Comprehensive Environmental Inc.
Ben Lundsted
21 Depot St
Merrimack NH 03054

Control #: 111792
Project Number: 131-65
Project Name: Harris Pond Dredging
Project Location: Harris Pond, Nashua NH

Lab ID: 18080245
Date: 8/29/2018

Lab ID: 18080245

Sample Receiving and Comment Summary

Were samples submitted with a chain of custody?	Yes
Do all samples received match the chain of custody?	Yes
Were all samples received within applicable holding times?	Yes
Were all containers intact when received?	Yes
Were samples for volatile organic analysis free of headspace (per method)?	N/A
Was there evidence of cooling or were samples received on the same day as collection?	Yes
If the sample pH was not correct was it adjusted where applicable?	Yes
Were samples for dissolved metals already filtered by the client or field sampling?	N/A
Were Samples for O-phos filtered in the field?	N/A
Were samples received in the appropriate containers?	Yes
Were samples submitted with a chain of custody?	Yes

Sample	Method	Client Identity	Matrix	Analyst
18080245-001	SW 8270D	Harris Pond Sediment	Solid	PaulF

Comment: Indeno(1,2,3-cd)pyrene recovered high in the CCV. Sample below detection limit for this compound.

**** Blank comment sections denote "No Comment"***

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Comprehensive Environmental Inc.
Ben Lundsted
21 Depot St
Merrimack NH 03054

Control #: 111792
Project Number: 131-65
Project Name: Harris Pond Dredging
Project Location: Harris Pond, Nashua NH

Analytical Results

Lab ID: 18080245
Date: 8/29/2018

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
18080245-001	Harris Pond Sediment	8/10/2018 9:00:00 AM	Solid

Composite Start Date and Time 8/10/2018 9:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Total Solids	In House	34 %		8/22/2018	1	0.1
Hot Plate Digestion	SW 3050B			8/20/2018	1	0
Extraction 8270C	SW 3546			8/23/2018	1	0
Extraction SW 3546	SW 3546			8/23/2018	1	0
Cadmium	SW 6010C	< 0.74 mg/kg dry Wt.		8/21/2018	1	0.74
Chromium	SW 6010C	7.90 mg/kg dry Wt.		8/21/2018	1	0.74
Lead	SW 6010C	18.4 mg/kg dry Wt.		8/21/2018	1	3.7
Nickel	SW 6010C	7.40 mg/kg dry Wt.		8/21/2018	1	0.74
Selenium	SW 6010C	< 7.4 mg/kg dry Wt.		8/21/2018	1	7.4
Silver	SW 6010C	< 0.74 mg/kg dry Wt.		8/21/2018	1	0.74
Zinc	SW 6010C	46.4 mg/kg dry Wt.		8/21/2018	1	0.74
Hexavalent Chromium	SW 7196A	< 5.92 mg/kg dry Wt.		8/21/2018	1	5.92
Mercury	SW 7471A	0.097 mg/kg dry Wt.		8/21/2018	1	0.0592
Total Other Petroleum Hydrocarbons	SW 8015	< 95000 ug/kg dry Wt.		8/25/2018	320.2	95000
TPH as Diesel	SW 8015	< 95000 ug/kg dry Wt.		8/25/2018	320.2	95000
TPH as Lube Oil	SW 8015	< 95000 ug/kg dry Wt.		8/25/2018	320.2	95000
1,1,1,2-Tetrachloroethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,1,1-Trichloroethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,1,2,2-Tetrachloroethane	SW 8260C	< 13 ug/kg dry Wt.		8/20/2018	8.6	13
1,1,2-Trichloroethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,1-Dichloroethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,1-Dichloroethene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,1-Dichloropropene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2,3-Trichlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2,3-Trichloropropane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2,4-Trichlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2,4-Trimethylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2-Dibromo-3-Chloropropane	SW 8260C	< 51 ug/kg dry Wt.		8/20/2018	8.6	51
1,2-Dibromoethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2-Dichlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2-Dichloroethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,2-Dichloropropane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,3,5-Trichlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,3,5-Trimethylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,3-Dichlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,3-Dichloropropane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
1,4-Dichlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
2,2-Dichloropropane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
18080245-001	Harris Pond Sediment	8/10/2018 9:00:00 AM	Solid

Composite Start Date and Time 8/10/2018 9:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
2-Butanone	SW 8260C	< 320 ug/kg dry Wt.		8/20/2018	8.6	320
2-Chlorotoluene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
2-Ethoxy-2-Methyl Propane (ETBE)	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
2-Hexanone	SW 8260C	< 320 ug/kg dry Wt.		8/20/2018	8.6	320
2-Methoxy-2-Methyl Butane (TAME)	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
2-Methoxy-2-Methyl Propane (MTBE)	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
2-Methyl-2-Propanol (TBA)	SW 8260C	< 510 ug/kg dry Wt.		8/20/2018	8.6	510
4-Chlorotoluene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
4-Isopropyltoluene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
4-Methyl-2-Pentanone	SW 8260C	< 250 ug/kg dry Wt.		8/20/2018	8.6	250
Acetone	SW 8260C	< 320 ug/kg dry Wt.		8/20/2018	8.6	320
Acrolein	SW 8260C	< 130 ug/kg dry Wt.		8/20/2018	8.6	130
Acrylonitrile	SW 8260C	< 130 ug/kg dry Wt.		8/20/2018	8.6	130
Benzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Bromobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Bromochloromethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Bromodichloromethane	SW 8260C	< 15 ug/kg dry Wt.		8/20/2018	8.6	15
Bromoform	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Bromomethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Carbon Disulfide	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Carbon Tetrachloride	SW 8260C	< 51 ug/kg dry Wt.		8/20/2018	17.2	51
Chlorobenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Chloroethane	SW 8260C	< 51 ug/kg dry Wt.	R	8/20/2018	17.2	51
Chloroform	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Chloromethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Cis-1,2-Dichloroethene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Cis-1,3-Dichloropropene	SW 8260C	< 10 ug/kg dry Wt.		8/20/2018	8.6	10
Dibromochloromethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Dibromomethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Dichlorodifluoromethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Diethyl Ether	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Di-Isopropyl Ether	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Ethylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Hexachlorobutadiene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	17.2	25
Isopropylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
M/P-Xylene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Methylene Chloride	SW 8260C	< 130 ug/kg dry Wt.		8/20/2018	8.6	130
Naphthalene	SW 8260C	< 51 ug/kg dry Wt.		8/20/2018	17.2	51
N-Butylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
N-Propylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
O-Xylene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Sec-Butylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Styrene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Tert-Butylbenzene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Tetrachloroethene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25

317 Elm Street
Milford, NH 03055
(603) 673-5440
Sales@chemservelab.com

Sample	Client Sample Identity	Start Date/Time Sampled:	Matrix
18080245-001	Harris Pond Sediment	8/10/2018 9:00:00 AM	Solid

Composite Start Date and Time 8/10/2018 9:00:00 AM **Composite End Date and Time**

Parameter	Method	Result	Qualifier	Date/Time Analyzed	Dilution Factor	RDL
Tetrahydrofuran	SW 8260C	< 320 ug/kg dry Wt.		8/20/2018	8.6	320
Toluene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Trans-1,2-Dichloroethene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Trans-1,3-Dichloropropene	SW 8260C	< 10 ug/kg dry Wt.		8/20/2018	8.6	10
Trichloroethene	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Trichlorofluoromethane	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
Vinyl Chloride	SW 8260C	< 25 ug/kg dry Wt.		8/20/2018	8.6	25
2-Methylnaphthalene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Acenaphthene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Acenaphthylene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Anthracene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Benzo[A]Anthracene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Benzo[A]Pyrene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Benzo[B]Fluoranthene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Benzo[G,H,I]Perylene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Benzo[K]Fluoranthene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Chrysene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Dibenz[A,H]Anthracene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Fluoranthene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Fluorene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Indeno[1,2,3-Cd]Pyrene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Naphthalene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Phenanthrene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900
Pyrene	SW 8270D	< 900 ug/kg dry Wt.		8/24/2018	305.5	900

Qualifier:	Description:
B-	Method blank contaminated with target analyte.
B1-	BOD had total oxygen loss. Result reported as ">"the highest dilution.
B2-	BOD had no oxygen loss. Result reported as "<" the lowest dilution.
G-	Reporting limit elevated due to matrix interference.
H-	Method prescribed holding time exceeded.
J-	Indicates an estimated value. Value is less than the quantitation limit.
IL-	Internal Standard(s) recovery was low due to matrix. Result may be biased high.
IH-	Internal Standard(s) recovery was high due to matrix. Result may be biased low.
LH-	Laboratory control spike(s) was high. Results may be biased high.
LL-	Laboratory control spike(s) was low. Results may be biased low.
MH-	Matrix spike recovery high due to matrix. Results may be biased high.
ML-	Matrix spike recovery low due to matrix. Results may be biased low.
N-	Non-target compound. Reported as a TIC.
NC-	Spike recovery was not calculated due to the concentration of the analyte being >4 times the concentration of the spike added.
R-	RPD outside acceptable recovery limits.
RO-	Sample received out of holding time.
SH-	Surrogate recovery high due to matrix
SL-	Surrogate recovery low due to matrix
U-	BOD/CBOD blank had an oxygen depletion greater than the suggested amount of 0.200.
V-	Sample pH for analysis was not within the required range when checked at time of analysis.
Z	Too numerous to count (TNTC)

An "A" in the result column on the report indicates absent for presence/absent bacteria and a "P" indicates present for presence/absent bacteria.

Surrogate Report

Client: Comprehensive Environmental Inc.

Order #: 18080245

Matrix: **Solid**

Units: **ug/L**

Sample Number	Surrogate	Method	Percent Recovery	Control Limits	Surrogate Amount	Surrogate Result
18080245-001	4-Bromofluorobenzene	SW 8260C	90.2	70-130	20	18.04
18080245-001	Dibromofluoromethane	SW 8260C	112.2	70-130	20	22.44
18080245-001	Toluene-d8	SW 8260C	79.05	70-130	20	15.81

Units: **ug/L**

Sample Number	Surrogate	Method	Percent Recovery	Control Limits	Surrogate Amount	Surrogate Result
18080245-001	2-Fluorobiphenyl	SW 8270D	74.44	30-130	25	18.61
18080245-001	Nitrobenzene-d5	SW 8270D	68.4	30-130	25	17.10
18080245-001	Terphenyl-d14	SW 8270D	93.4	30-130	25	23.35

Chain of Custody No. 111792
Multiple COC's Yes (No)

ChemServe ENVIRONMENTAL ANALYSTS

CHAIN OF CUSTODY

317 Elm Street Milford, NH 03055
(603) 673-5440/ Fax (603) 673-0366

A CUSTOMER INFORMATION

CUSTOMER: Comprehensive Environmental Inc
ADDRESS: 21 Depot St.
CITY/STATE/ZIP Merrimack, NH 03054
TELEPHONE: 603-429-3584
REPORT TO: Ben Lundsted
EMAIL TO: blundsted@ceiengineers.com

B PROJECT INFORMATION

JOB NAME: Harris Pond Dredging
JOB NUMBER: 131-65
LOCATION: Harris Pond, Nashua, NH
INVOICE EMAIL: mkneeland@ceiengineers.com
INVOICE TO: Ben Lundsted
P.O. NUMBER:

C SAMPLE INFORMATION

TURNAROUND TIME: (CIRCLE ONE:)
(10 DAY STANDARD) RUSH (MUST BE PRE-APPROVED)
7day 5 day 4 day 3 day 2 day 1 day Same Day

MCP ☐ YES ☒ NO ☐ GWI ☐ GW2 ☐ GW3

STATION # (D)	SAMPLE IDENTIFICATION & LOCATION (E)	COLLECTED (F) DATE	COLLECTED (G) TIME	SAMPLE TYPE (H) GRAB	SAMPLE TYPE (H) COMP	(I) MATRIX SOLID (S) GROUND WATER (G) DRINKING WATER (D) WASTE WATER (W)	(J) # OF CONTAINERS	(K) CONTAINER AND PRESERVATIVE: Jar / None	6187 A VOC									(L) ANALYSIS
1	Harris Pond Sediment	8/10/18	9:00		X	S	2	1	1									VOC, PAH, TPH Metals
		DATE	TIME															
		DATE	TIME															
		DATE	TIME															
		DATE	TIME															
		DATE	TIME															
		DATE	TIME															
		DATE	TIME															

M CUSTODY

SAMPLER: Jeff Koloski (print name)
SIGNATURE:

	DATE	MILITARY TIME
RELINQUISHED:	8/14/18	11:33
RECEIVED:	8/14/18	11:32
RELINQUISHED:	8/14/18	13:-
RECEIVED FOR LAB:	8/14/18	13:00

SAMPLE CHECK LIST:
RECEIVED WITHIN HOLD TIME (YES) OR NO
RECEIVED IN GOOD CONDITION (YES) OR NO
TEMP BLANK 8.1 °C
SHIPPED OR (HAND) DELIVERED
SAMPLES WERE PROPERLY PRESERVED (YES) NO N/A
SAMPLES WERE FILTERED IN FIELD LAB (N/A)
IF NO EXPLAIN:

GROUP # 18080245 8/21

FIELD READING(S) & COMMENTS:

Work Order Modification

Submitted By: CB Date/Time: 8/15/18 11:15

Client ID: CET

Lab ID/Control #: 18080245 Sample ID:

Contacted: Nick Shaw Email/Phone:

	TAT Change to:		*Clarification- info missing or unclear:*
	Add analyses		- Sample Collection Date/Time
	Cancel analyses		- Matrix – DW, GW, WW, Solid
	Incorrect preservative	X	- Analysis
	Insufficient sample quantity		- Sample Identification
	Hold time exceeded		- TAT
	Received outside temperature range		- Address or Project Location
	Samples on hold		- Other

Note: COCs received with insufficient information may not meet regulatory requirements

Details:

which metals?

Action: Revised Report:

~~Report 8 Metals~~ (nc)
+ Cr-6, Cd, Cr, Pb, Hg, Ni, Se, Ag, Zn
See Attached

CB Cowell

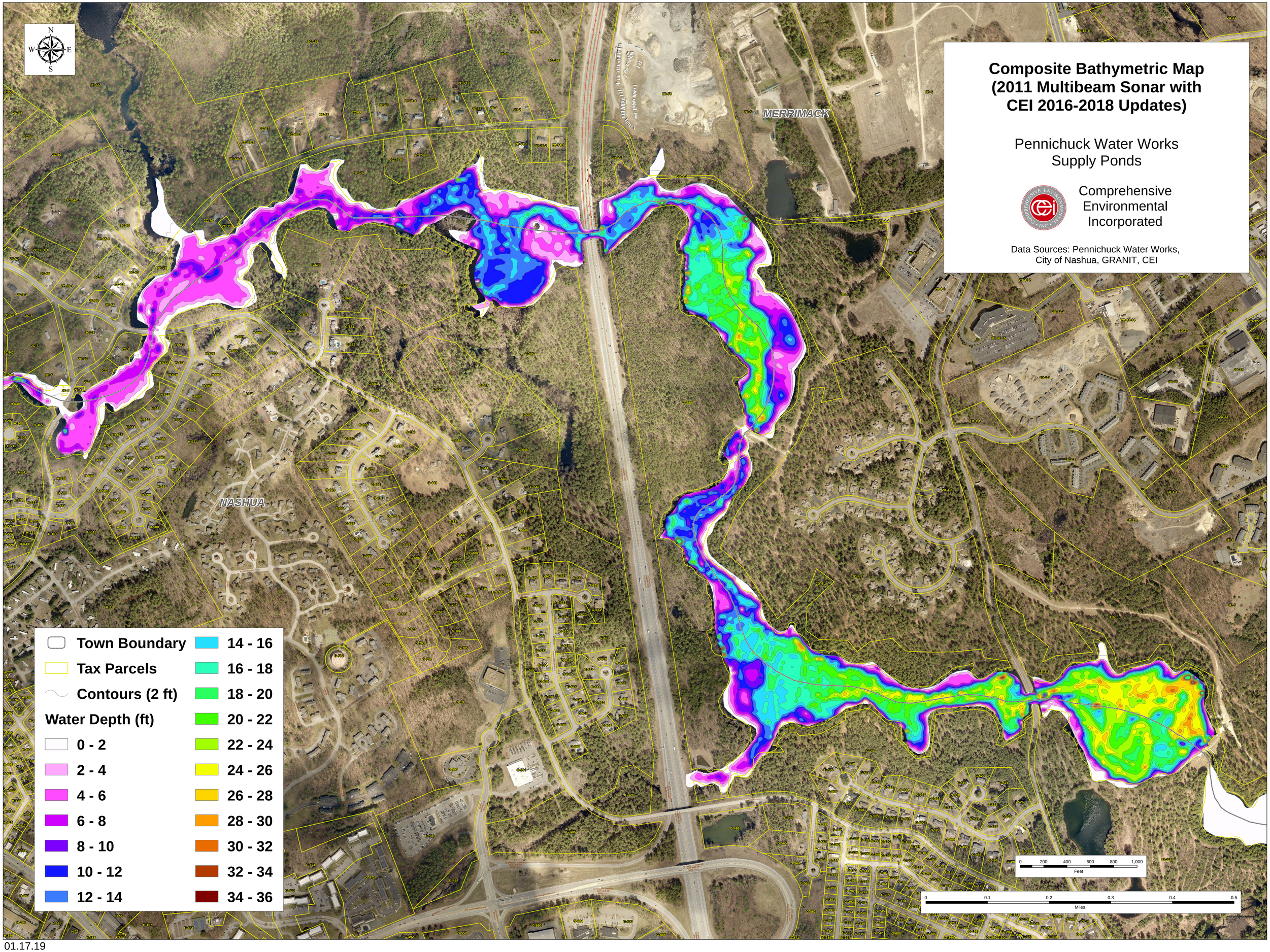
Processed By Sample Custodian

8-15-18

Date

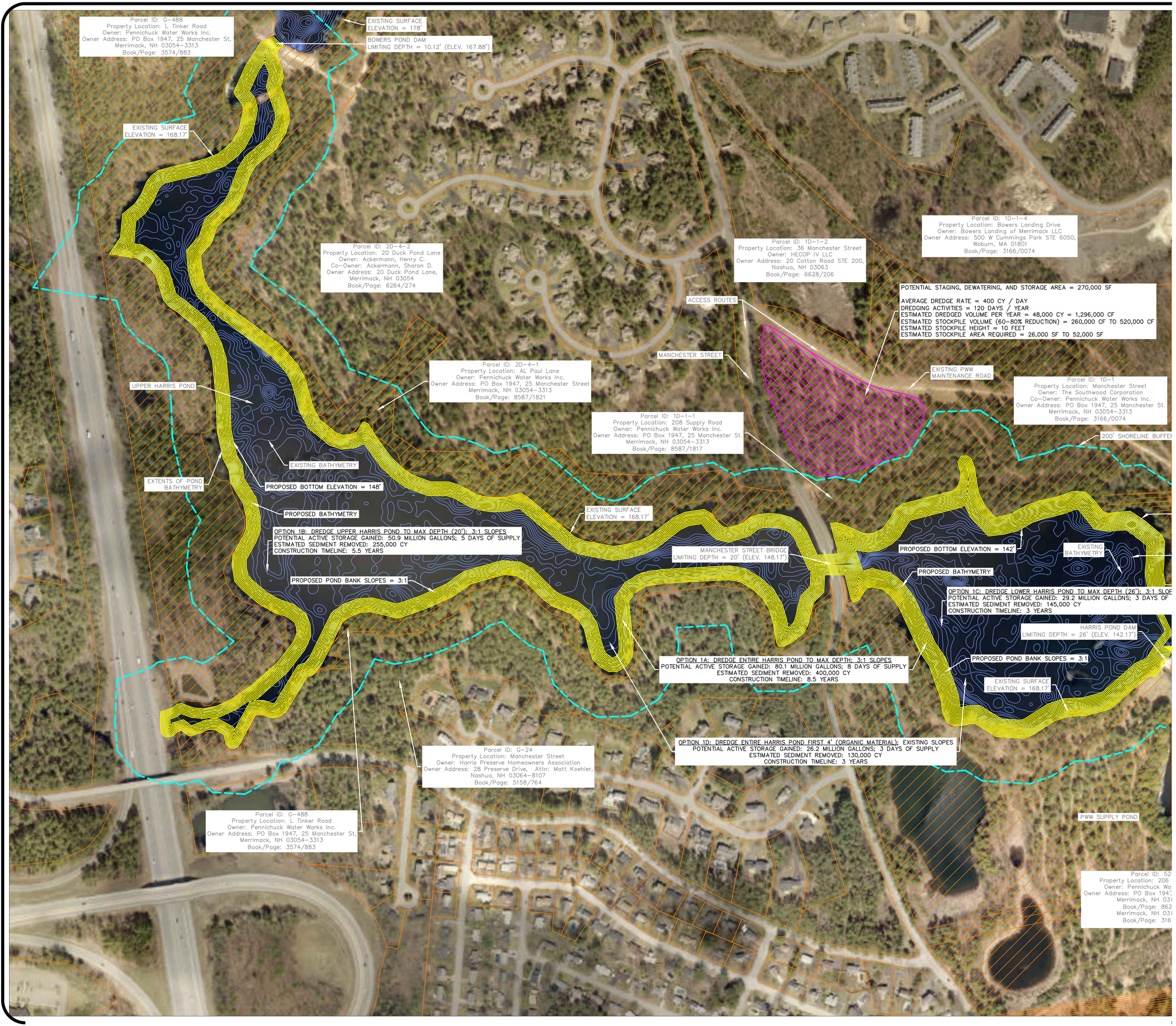
Lab Director	
Customer Service	✓
QA	
Accounting	Invoice? (Y) N
File Drawer	✓
Organics	
Inorganics	

Appendix G
Pennichuck Brook Bathymetric Map


Composite Bathymetric Map
(2011 Multibeam Sonar with
CEI 2016-2018 Updates)
Pennichuck Water Works
Supply Ponds
Comprehensive
Environmental
Incorporated
Data Sources: Pennichuck Water Works,
City of Nashua, GRANIT, CEI
N
W
E
S
MERRIMACK
NASHUA
Town Boundary
Tax Parcels
Contours (2 ft)
Water Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
16 - 18
18 - 20
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 32
32 - 34
34 - 36
0 200 400 600 800 1,000
Feet
0 0.1 0.2 0.3 0.4 0.5
Miles

01.17.19

Appendix H
Dredging Options Summary Table and Figure


Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883
EXISTING SURFACE ELEVATION = 178'
BOWERS POND DAM
LIMITING DEPTH = 10.12' (ELEV. 167.88')
EXISTING SURFACE ELEVATION = 168.17'
Parcel ID: 2D-4-2
Property Location: 20 Duck Pond Lane
Owner: Ackermann, Henry C.
Co-Owner: Ackermann, Sharon D.
Owner Address: 20 Duck Pond Lane,
Merrimack, NH 03054
Book/Page: 6264/274
Parcel ID: 1D-1-2
Property Location: 36 Manchester Street
Owner: HECOP IV LLC
Owner Address: 20 Cotton Road STE 200,
Nashua, NH 03063
Book/Page: 6628/206
Parcel ID: 1D-1-4
Property Location: Bowers Landing Drive
Owner: Bowers Landing of Merrimack LLC
Owner Address: 500 W Cummings Park STE 6050,
Woburn, MA 01801
Book/Page: 3166/0074
POTENTIAL STAGING, DEWATERING, AND STORAGE AREA = 270,000 SF
AVERAGE DREDGE RATE = 400 CY / DAY
DREDGING ACTIVITIES = 120 DAYS / YEAR
ESTIMATED DREDGED VOLUME PER YEAR = 48,000 CY = 1,296,000 CF
ESTIMATED STOCKPILE VOLUME (60-80% REDUCTION) = 260,000 CF TO 520,000 CF
ESTIMATED STOCKPILE HEIGHT = 10 FEET
ESTIMATED STOCKPILE AREA REQUIRED = 26,000 SF TO 52,000 SF
ACCESS ROUTES
MANCHESTER STREET
EXISTING PWW MAINTENANCE ROAD
Parcel ID: 2D-4-1
Property Location: AL Paul Lane
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester Street
Merrimack, NH 03054-3313
Book/Page: 8587/1821
Parcel ID: 1D-1
Property Location: Manchester Street
Owner: The Southwood Corporation
Co-Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 3166/0074
UPPER HARRIS POND
Parcel ID: 1D-1-1
Property Location: 208 Supply Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 8587/1817
200' SHORELINE BUFFE
EXISTING BATHYMETRY
EXTENTS OF POND BATHYMETRY
PROPOSED BOTTOM ELEVATION = 148'
PROPOSED BATHYMETRY
EXISTING SURFACE ELEVATION = 168.17'
OPTION 1B: DREDGE UPPER HARRIS POND TO MAX DEPTH (20'); 3:1 SLOPES
POTENTIAL ACTIVE STORAGE GAINED: 50.9 MILLION GALLONS; 5 DAYS OF SUPPLY
ESTIMATED SEDIMENT REMOVED: 255,000 CY
CONSTRUCTION TIMELINE: 5.5 YEARS
MANCHESTER STREET BRIDGE
LIMITING DEPTH = 20' (ELEV. 148.17')
PROPOSED BOTTOM ELEVATION = 142'
EXISTING BATHYMETRY
PROPOSED BATHYMETRY
PROPOSED POND BANK SLOPES = 3:1
OPTION 1C: DREDGE LOWER HARRIS POND TO MAX DEPTH (26'); 3:1 SLOP
POTENTIAL ACTIVE STORAGE GAINED: 29.2 MILLION GALLONS; 3 DAYS OF
ESTIMATED SEDIMENT REMOVED: 145,000 CY
CONSTRUCTION TIMELINE: 3 YEARS
HARRIS POND DAM
LIMITING DEPTH = 26' (ELEV. 142.17')
OPTION 1A: DREDGE ENTIRE HARRIS POND TO MAX DEPTH; 3:1 SLOPES
POTENTIAL ACTIVE STORAGE GAINED: 80.1 MILLION GALLONS; 8 DAYS OF SUPPLY
ESTIMATED SEDIMENT REMOVED: 400,000 CY
CONSTRUCTION TIMELINE: 8.5 YEARS
PROPOSED POND BANK SLOPES = 3:1
EXISTING SURFACE ELEVATION = 168.17'
OPTION 1D: DREDGE ENTIRE HARRIS POND FIRST 4' (ORGANIC MATERIAL); EXISTING SLOPES
POTENTIAL ACTIVE STORAGE GAINED: 26.2 MILLION GALLONS; 3 DAYS OF SUPPLY
ESTIMATED SEDIMENT REMOVED: 130,000 CY
CONSTRUCTION TIMELINE: 3 YEARS
Parcel ID: G-24
Property Location: Manchester Street
Owner: Harris Preserve Homeowners Association
Owner Address: 28 Preserve Drive, Attn: Matt Koehler,
Nashua, NH 03064-8107
Book/Page: 5158/764
Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883
PWW SUPPLY POND
Parcel ID: 52
Property Location: 206
Owner: Pennichuck Wa
Owner Address: PO Box 194
Merrimack, NH 031
Book/Page: 862
Merrimack, NH 031
Book/Page: 316

Active Storage Improvement Options	Description	Gained Storage (million gallons)	Gained Supply (days)	Total Costs	Cost per Storage Gained ($/million gallons)	Potential Permitting Requirements	Engineering / Construction Considerations	Time to Completion
(1) Dredging	(1a) Dredge Upper and Lower Harris Pond to the maximum depths; maintain 3:1 side slopes	80.1	8	Permitting: $100,000 Engineering/Oversight: $150,000 Sampling: $20,000 Construction[1]: $7,400,000 Total: $7,670,000	$95,800	1. U.S. Army Corp of Engineers - State Programmatic General Permit (SPGP) or Individual Permit (IP) 2. NHDES Alteration of Terrain Permit Application (RSA 485-A:17, Env-Wq 1500) 3. NHDES Shoreland Permit Application (RSA 483-9, Env-Wq 1400) 4. NHDES Wetland Permit Application (Major) (RSA 482-A, Env-Wq 100-900) - Waste Management Division Review - 401 Water Quality Certification Program - NH Natural Heritage Bureau (NHB) Review - NH Division of Historical Resources (DHR) Review - NH Fish & Game Department (FGD) Review	1. Dredge Material - 400,000 / 255,000 / 145,000 / 130,000 CY - estimated dredged material[2] - 120,000 / 76,500 / 43,500 / 39,000 CY - estimated dewatered material[3] - 20 / 16 / 13 / 12 samples - estimated based on example sampling protocol[4] 2. Dredging / Dewatering Methods - mechanical dry dredging - mechanical wet dredging - hydraulic/pneumatic dredging (recommended) - quantity and physical characteristics of dredge material - full or partial pond drawdown not feasible for multi-year dredge project 3. Access Routes / Staging / Dewatering / Storage Areas - outside of the 200' shoreline buffer - PWW property - existing maintenance road / Manchester Street - multiple access points 4. Disposal / Reuse Options - quantity and chemical characteristics of dredge material - develop sampling plan - contaminant delineation and treatment - reuse locations / certified treatment or disposal facilities	Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 8.5 years Total: 10 - 11.5 years
	(1b) Dredge Upper Harris Pond to the maximum depth of 20'; maintain 3:1 side slopes	50.9	5	Permitting: $100,000 Engineering/Oversight: $125,000 Sampling: $16,000 Construction[1]: $4,720,000 Total: $4,961,000	$97,500			Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 5.5 years Total: 7 - 8.5 years
	(1c) Dredge Lower Harris Pond to the maximum depth of 26'; maintain 3:1 side slopes	29.2	3	Permitting: $100,000 Engineering/Oversight: $100,000 Sampling: $13,000 Construction[1]: $2,690,000 Total: $2,903,000	$99,450			Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 3 years Total: 4.5 - 6 years
	(1d) Dredge Upper and Lower Harris Pond; first 4 feet of material (organic material); maintain existing side slopes	26.2	3	Permitting: $100,000 Engineering/Oversight: $100,000 Sampling: $12,000 Construction[1]: $2,410,000 Total: $2,622,000	$100,100			Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 3 years Total: 4.5 - 6 years

[1]Based on an average hydraulic dredging cost of $18.50 per CY of dredge material removed and dewatered.
[2]Estimated dredge material removed in dredging scenario 1a, 1b, 1c, and 1d, respectively.
[3]Estimated dewatered material in dredging scenario 1a, 1b, 1c, and 1d, respectively. Based on 60-80% volume reduction of dredged material after dewatering.
[4]Estimated additional samples required in dredging scenario 1a, 1b, 1c, and 1d, respectively. Example sampling protocol: one sample per 2,000 CY up to 20,000 CY, and then one sample per 10,000 CY. Results above soil remediation standards may require more sampling and consistent results below soil remediation standards may warrant less sampling. Sampling protocol may be subject to review/suggestions by NHDES Waste Management Division. Estimated $1000 per sample/lab analysis.
[5]Based on average dredge rate of 400 CY per day for duration of 120 days per year. 48,000 CY can be dredged per year.

Appendix I
Quality Assurance Project Plan (QAPP)

QUALITY ASSURANCE PROJECT PLAN FOR:

Harris Pond Dredging Feasibility Study - Pennichuck Water Works

Operated Under:
New Hampshire Department of Environmental Services Local Source Water Grant Program
SWP # 286

Prepared by
Comprehensive Environmental Inc. (CEI)
21 Depot Street, Merrimack, NH 03054
800-725-2550

Prepared for
EPA New England (Region 1)
5 Post Office Square - Suite 100, Boston, MA 02109
888-372-7341

Approval Signatures (required prior to project start):

CEI - Technical Project Manager: 5-10-19
Signature/Date
Benjamin Lindsay, P.E.

CEI - QA Officer & Data Evaluator: 5/29/2019
Signature/Date
Robert Hartzel, CLM

Pennichuck Water Works - Project Manager/Grantee: 5/30/2019
Signature/Date
Donald Ware, P.E.

NHDES – Project Manager: 5-9-19
Signature/Date
Andrew Madison

NHDES Quality Assurance Manager: 5/9/19
Signature/Date
Daniel Hrobak

For Receipt:
US EPA Project Manager 5-9-
Signature/Date
Erik Beck, US EPA Region I

US EPA QA Reviewer: 5/3/2019
Signature/Date
Nora Conlon, US EPA Region I

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1.0 Distribution List

Table 1 lists the individuals who will receive signed copies of this Quality Assurance Project Plan (QAPP) and all subsequent revisions.

Table 1. QAPP Distribution List

QAPP Recipient	Title / Project Role	Organization	Contact Information
Donald Ware, P.E.	Grantee and Project Manager	Pennichuck Water Works	603-913-2330 donald.ware@pennichuck.com
Benjamin Lundsted, P.E.	Technical Project Mgr.	Comprehensive Environmental, Inc.	800-725-2550 x317 blundsted@ceiengineers.com
Robert Hartzel, CLM	QA Officer & Data Evaluator	Comprehensive Environmental, Inc.	800-725-2550 x352 rhartzel@ceiengineers.com
Stephanie Hanson	Wetland Specialist & Data Evaluator	Comprehensive Environmental, Inc.	800-725-2550 x318 shanson@ceiengineers.com
Josephine Hatton	GIS Specialist	Comprehensive Environmental, Inc.	800-725-2550 x350 jhatton@ceiengineers.com
Andrew Madison	NHDES Project Manager	NHDES, Drinking Water and Groundwater Bureau	603-271-2950 Andrew.Madison@des.nh.gov
Vince Perelli	NHDES QA Manager	NHDES, Planning, Prevention, & Assistance Unit	603-271-8989 Vincent.Perelli@des.nh.gov
Erik Beck	USEPA Project Manager	USEPA New England	617-918-1606 beck.erick@epa.gov
Nora Conlon	USEPA QA Reviewer	USEPA New England	617-918-8335 conlon.nora@epa.gov

2.0 Project Organization, Responsibilities, and Objectives

2.1 Purpose of Study and Background Information

Pennichuck Water Works (PWW), established in 1852, is the largest subsidiary of the Pennichuck Corporation engaged in the collection, storage, treatment, distribution, and sale of potable water. PWW serves the City of Nashua, New Hampshire and 10 surrounding municipalities, supplying water to population of approximately 110,000.

PWW collects its water from the Pennichuck Brook Watershed, which includes five southern New Hampshire towns (Nashua, Merrimack, Amherst, Milford, and Hollis) and has an overall area of 17,300 acres. The primary water supply consists of about 195 acres of water in a series of chain ponds that includes Harris Pond, Bowers Pond, and Holts Pond, with various other storage ponds upstream of these water supply ponds. The supply ponds are shown on the USGS topographical map in Figure 1. The Pennichuck Brook Watershed is depicted in Figure 2.

Figure 1. USGS Locus Map

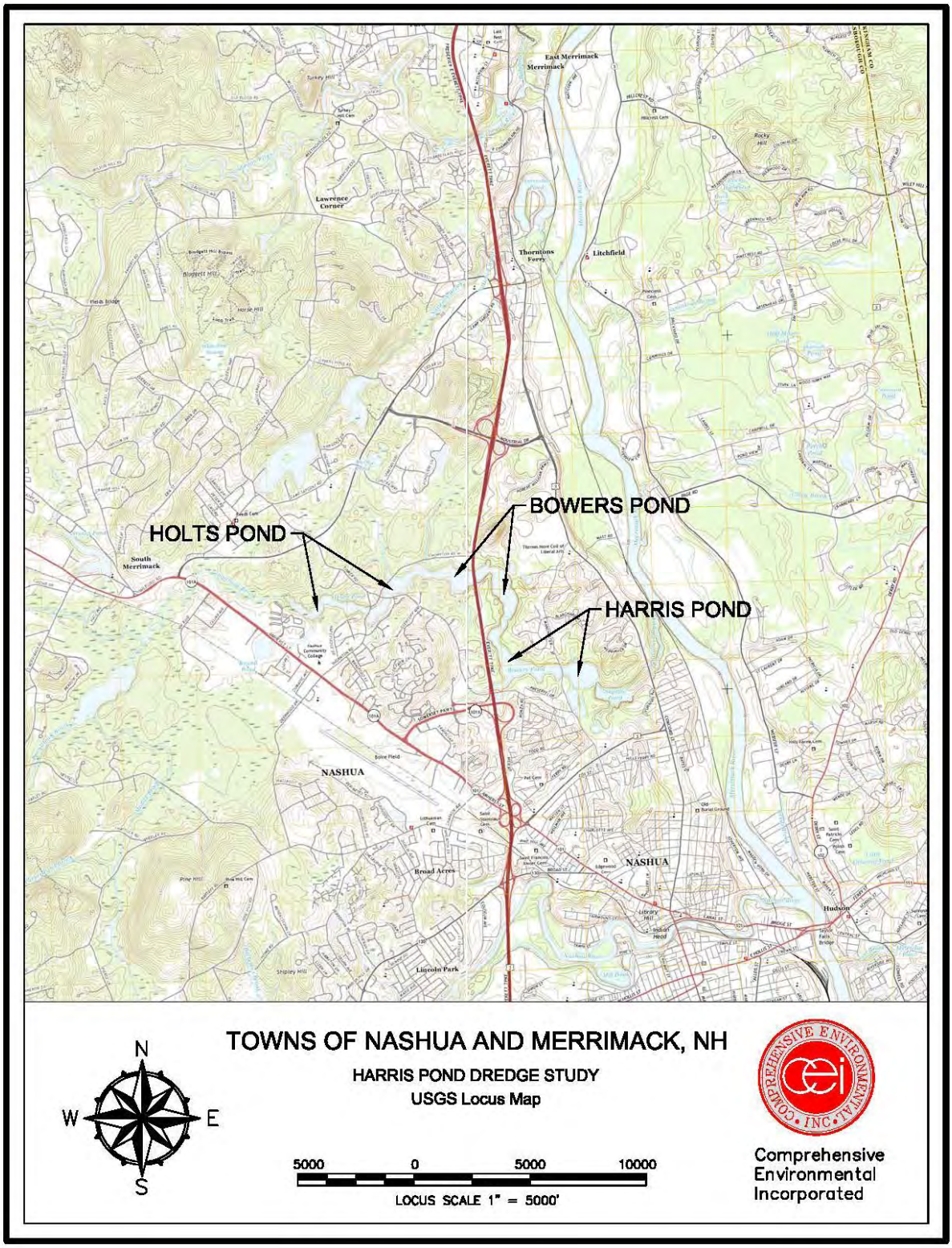
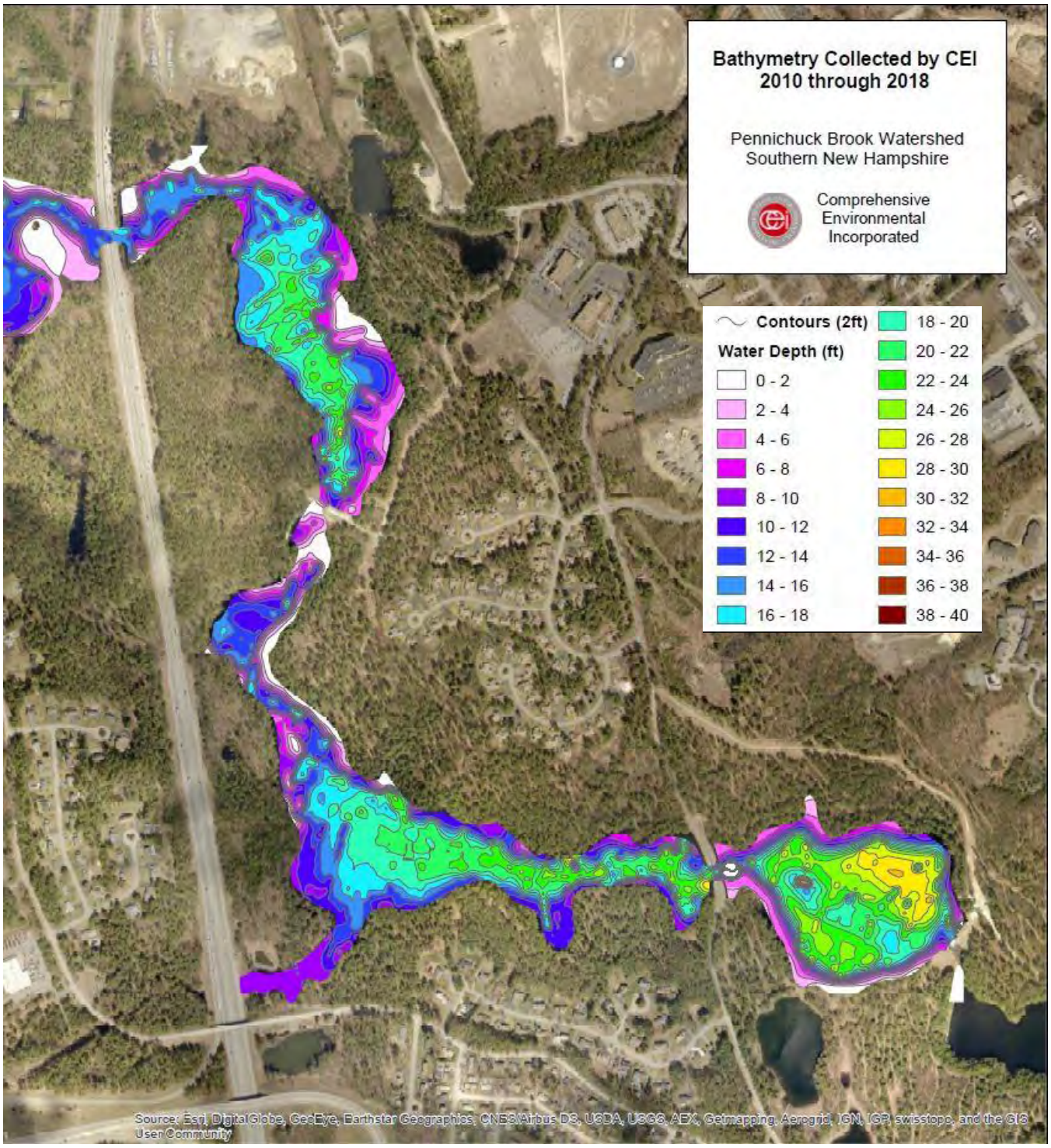


Figure 2. Pennichuck Supply Pond Map



Comprehensive Environmental, Inc. (CEI) worked on behalf of PWW between the years of 2000 and 2018 to evaluate sediment accumulation and inputs in the Pennichuck water supply ponds. The primary goals of these investigations were to (1) characterize the areas where storage was being lost, (2) estimate the rate of storage loss, and (3) develop measures to reduce storage loss and improve water supply storage capacity within the ponds where feasible. The most recent assessment of sediment accumulation, sources, and inputs was completed in 2017. It was concluded through this study that both Harris and Bowers Ponds could benefit from dredging to increase active storage volume, with Harris Pond containing the greatest volume of sediments occupying the active storage area. This means that accumulated sediment is occupying active storage that would otherwise be dedicated to drinking water, and also threatening to migrate down to the treatment plant, as Harris Pond is the closest supply pond to the plant. As a result of this assessment, PWW decided to explore the feasibility of dredging Harris Pond.

This project, which is partially funded under the 2018 New Hampshire Department of Environmental Services (NHDES) Source Water Protection Grant (SWPG), will involve a dredging feasibility study for Harris Pond. PWW has selected CEI to perform the study, which will evaluate the options, logistics, and costs associated with dredging the pond.

2.2 Project Objectives

The main objectives of the Harris Pond Dredging Feasibility Study are to:

1. Assess the potential to safely remove and dispose sediment within Harris Pond with minimal impacts to operations;
2. Identify and recommend areas to dredge;
3. Evaluate dredge methods and operations;
4. Quantify and classify dredged material for handling and disposal requirements;
5. Evaluate potential environmental and resource impacts to address potential permitting issues;

Secondary data will be used to estimate the disturbance of wetland resource areas and other natural community types within the Pennichuck Brook watershed that might result from dredging, as well as the potential benefits of dredging Harris Pond.

2.3 Secondary Data Needed

The secondary data needed are environmental data in various forms and from various sources that serve as indicators of the watershed's land resources. This data shall cover the primary concerns surrounding the dredging of Harris Pond for access, staging, dredging methods, support operations and ultimate sediment removal to complete this work. Data will be used to identify;

- The possible locations for dredging;
- The quantity of dredged material;
- Dredged material characteristics;
- Optional dredge methods and operations;
- Optional equipment access to dredging areas.
- Time line for dredging;

- The location of staging and support operations;
- Special operation needs such as bypass piping, pumps, temporary back-up support facilities;
- The presence of nearby wetland resource areas;
- The presence of nearby rare and/or endangered species habitats;
- The presence of other sensitive areas or abutters; and
- The potential dredged material disposal or re-use locations;

Additional primary data will include on-site field observations of potential dredge access, operation and staging areas to confirm secondary data collected from web sources containing resource area and habitat information. Field evaluations will be completed to confirm the presence and type of jurisdictional resource areas that have been identified from web sources to be near the proposed work. The presence of nearby important habitat features will also be confirmed via field observations to confirm the collected web rare and/or endangered species habitats. These evaluations will confirm tree species, upland habitat information and aquatic habitat data to review potential impacts to those nearby habitats from any proposed earthwork, tree clearing, water level adjustments and other dredging operations. Field data collected will be reviewed for consistency and if deviations occur between primary and secondary data, it will be documented in a memo and the QA Officer will meet with the Wetland Specialist to confirm those deviations.

Additionally information collected from previous projects undertaken by PWW will include: previous sediment mapping and bathymetry data to be used to identify dredge zones and locations; sediment characteristics and laboratory analysis to be used to evaluate dredge methods, dewatering, handling and disposal/reuse options; aquatic plant evaluations to identify dredge zones and locations; average pond water levels, source consumption data and other drinking water operation data to be used to identify the dredge methods, dredge operations, project timing and potential phasing; wetland maps, rare species habitat maps, and aerial imagery (including drone imagery from the Harris Pond Portion of the Pennichuck Brook watershed).

Based on the desired information, secondary data will be broken into the following criteria categories to evaluate options and feasibility:

- Dredged material quantity;
- Dredged material quality;
- Dredge operations;
- Water supply operations;
- Dredged material disposal / re-use; and
- Environmental Impacts.

Secondary data needed will be evaluated and used to complement multiple data sources rather than as standalone information to verify whether the data is consistent between sources, any trends or consistent results can be identified or whether the data sources require more interpretation. For example, adjacent wetland classifications and extents collected from the National Wetland Inventory may be supplemented and/or confirmed through field data collection and observations. Various indicators across multiple data types will thus form a body of evidence for the dredged material, dredge zone locations and the land

resources surrounding Harris Pond to complete the evaluation. Additionally, data manipulation will be limited to the maximum extent practical, but if it becomes necessary, the data source and method of manipulation will be documented as noted in Sections below.

Data of the best quality available will be preferred. However, data with deficiencies or gaps will not automatically be excluded, as these data could be valuable in illustrating the state of knowledge surrounding the Harris Pond site, and indicate where on-site field observations may be necessary for the collection of more complete and/or more accurate information.

2.4 Planned Approach

The use of secondary data in the detection and evaluation of existing sensitive natural resources and habitats surrounding Harris Pond is due in part to the undeveloped nature of the site, along with its size. Because it would be difficult and unfeasible to survey the forested perimeter of the entire pond on foot, remote sensing data is the method of choice for this study. This type of secondary data information will be used to evaluate the following dredge feasibility components:

- Site access restrictions (dredge operations & sediment quantity);
- Potential staging, storage and dredge locations through sensitive un-developed areas (dredge operations & environmental impacts);
- Any permit restrictions, required water levels and other potential environmental impacts (environmental impacts);
- Potential sediment disposal and re-use locations (sediment quantity, quality & environmental impacts).

Topographic mapping, aerial imagery and drone footage will be observed and analyzed for the presence of sensitive environmental resources such as wetlands or vernal pools; surface type cover and land use (e.g. deciduous forests, open urban land, scrub shrub, etc.); and shoreline conditions. Some of this information will be confirmed through field investigations. This information will be documented using the following procedures:

1. Certified Wetland Scientist will delineate resource areas in accordance with ACOE Wetlands Delineation Manual;
2. The resource areas will be flagged based on those procedures and documented using ACOE field evaluation forms;
3. The spatial locations of the wetland delineation flags will be collected using a GPS;
4. Field data collected will then be imported into GIS and overlaid with the available online resource area delineations (secondary data); and,
5. The differences between field data and secondary data will be documented using GIS mapping and provided in the final report along with the field evaluation forms.

Nearby wetlands, sensitive resource areas, rare or endangered species habitat will also be collected from various sources noted in Section 3.1 below. Habitat data such as dominant tree types/ species or the presence of wetlands, streams, vernal pools and other observable features will be cross referenced in the field for compatibility with available online habitat data, but no wildlife field assessments or investigations will be completed as part of this work. These data will be used for the consideration and identification of

potential access routes for dredging equipment machinery and any potential temporary storage / disposal locations.

Additionally, secondary data will be provided from historic studies completed by Pennichuck and/or operational / anecdotal information provided by Pennichuck staff familiar with the area and overall drinking water supply operations. Previous project reports, studies and previously collected databases will be useful in estimating the following:

- Dredging locations and depths (sediment quantity);
- The necessary volume of sediment that would be removed from Harris Pond in order to restore desired active storage space (sediment quantity);
- Operational restrictions on dewatering depths and access to sediment and volumes (operational & sediment quantity);
- The physical and chemical characteristics of sediment (sediment quality & material disposal). Data evaluators will review laboratory data for quality of dredged material and compare these results to the New Hampshire Department of Environmental Services (NHDES) regulated contaminant standards for soil remediation (the list of specific analytes and associated numerical concentrations are listed in Env-Or 606.19, Table 600-2 in the New Hampshire Code of Administrative Rules provided in Appendix A). These comparisons will be summarized in a table in the final report. The QA officer will review the comparison table and laboratory QA/QC protocols to determine the quality of secondary data and comparison results.
- Potential operational restrictions to maintain and protect drinking water supply during dredging (water supply operations);
- Potential time of year, duration restrictions and phasing for dredging operations to minimize impacts to wildlife, abutters and drinking water supply operations (dredge operations & water supply operations);
- Potential bypassing needs & emergency backup equipment necessary to maintain on-going operations (water supply operations).

Available reports, databases and operation information that will be used for these assessments will be collected from various sources noted in Section 3.1 below.

2.5 Project Organization and Responsibilities

Figure 3 outlines the organization structure of the project personnel.

Figure 3. Project Organizational Chart

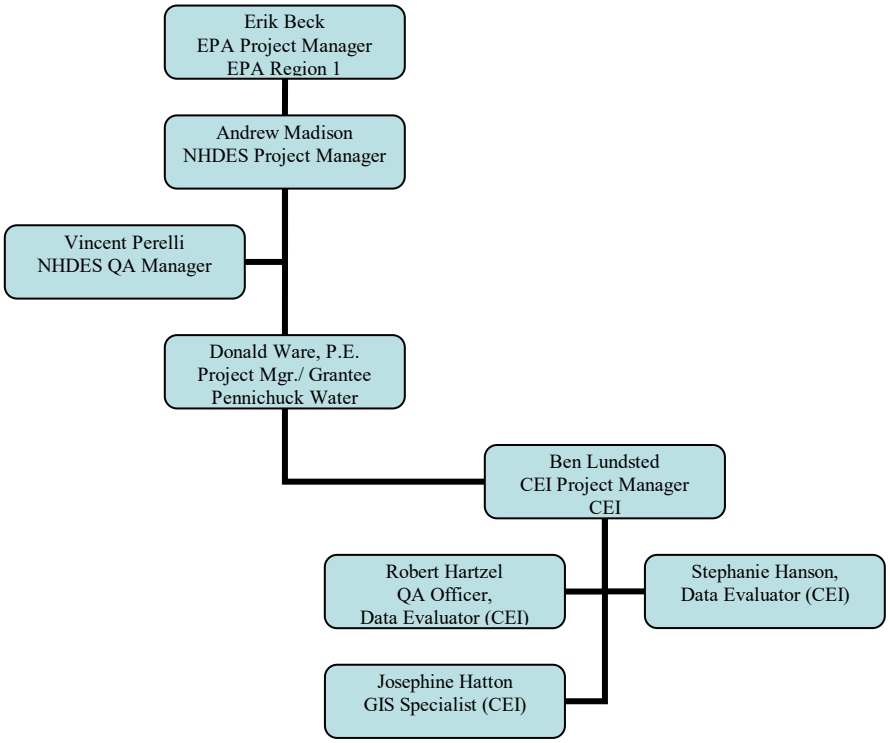


Table 2 identifies the roles and responsibilities of those individuals involved in the project.

Table 2. Personnel Responsibilities and Qualifications

Name and Affiliation	Responsibilities	Qualifications
Benjamin Lundsted, CEI	Project Manager	See below
Robert Hartzel, CEI	QA/QC Officer & Data Evaluator	See below
Stephanie Hanson, CEI	Data Evaluator	See below
Josephine Hatton, CEI	GIS Specialist	See below
Andrew Madison, NHDES, Drinking Water and Groundwater Bureau	Reviews and oversees projects funded by Source Water Protection Grants	On file at NHDES
Vince Perelli, NHDES Planning, Prevention & Assistance Unit	Reviews and approves QAPPs	On file at NHDES
Erik Beck, US EPA Region I	EPA Project Manager	On file at US EPA

Donald Ware, P.E., is the Project Manager and Grantee for this project. He is responsible for managing the grant project and is the chief liaison between NHDES, CEI, and Pennichuck. He will be responsible for managing subcontracts and appropriating procurement of funds for the Harris Pond project. He will also be responsible for the review of the feasibility report and associated site plan/map. He will review the required grant documentation and provide project oversight as Grantee for Pennichuck.

Benjamin Lundsted, P.E. will serve as CEI's Technical Project Manager. He is a registered

Professional Engineer in New Hampshire with 20 years of experience in all aspects of civil design, environmental permitting, water quality assessment, and construction oversight. Ben will be responsible for overseeing all aspects of dredge feasibility, dredging locations, data collection, cost estimating, evaluation of alternatives as well as the additional work associated with this grant. He is responsible for coordinating with CEI representatives the work required to complete the dredging feasibility and submittal of the final feasibility report.

Robert Hartzel will serve as CEI's Project QA Officer and Data Evaluator. He will be responsible for providing CEI's internal technical quality control and assurance for resource area assessments, dredging location selection, and alternative evaluations. He is a Certified Lake Manager and wetland scientist with over 25 years of experience in all aspects of data analysis, quality assurance, and project management for water resources assessment and restoration projects, including dredging feasibility assessments.

Stephanie Hanson of CEI will serve as a Data Evaluator and will be responsible for reviewing data sources and evaluating resource areas, dredging locations and alternative evaluations. She is a Certified Ecologist and wetland scientist with over 20 years of experience in all aspects of environmental assessments.

Josephine Hatton is a CEI Project Scientist and GIS Specialist with a wide variety of experience analyzing and evaluating land use, topographic and ortho-mosaic information, environmental resource, and municipal infrastructure data. Her GIS support includes the collection of demographic, cadastral and natural data from difference sources and integrating data to conduct geospatial or statistical analysis.

Andrew Madison, NHDES Project Manager, will oversee all aspects of the grant project and will manage the review process and submittal by CEI of the Final Grant Reporting documents to NHDES and the U.S. Environmental Protection Agency (USEPA). Mr. Madison will also review Grant Reporting/Status and process and track Payment Requests/Match Documentation for the project, and provide quality assurance and technical review.

Vincent Perelli of NHDES will review and approve this QAPP. The final version of this QAPP will be transmitted to **Erik Beck** of USEPA for receipt.

2.6 Project Schedule

The Source Water Protection Grant for this project was approved in May of 2018. The QAPP will be completed and submitted for review to NHDES and EPA. Following final QAPP approval, CEI will begin to conduct data collection, review and evaluation for the dredging feasibility study. The final dredging feasibility report will be completed and submitted to NHDES prior to the end of the grant period by May 31, 2019.

Table 3 provides a proposed project schedule for completing data reviews, quality control procedures and dredging feasibility.

Table 3. Project Schedule

Activity	Approximate Date of Initiation	Approximate Date of Completion	Product
Draft QAPP & submission to NHDES	8/20/2018	3/22/2019	Draft QAPP
QAPP review and final draft	3/22/2019	4/25/2019	Final QAPP
Data collection for dredging locations and sediment quantities	4/26/2019	5/1/2019	Support documents for selection of dredge locations & quantities
Data collection for access, staging, support locations and nearby resource areas	4/26/2019	5/1/2019	Support documents for dredge operations and resource areas
Data review and assessment	4/26/2019	5/1/2019	Summary of data review
Summary of alternatives and cost estimates	4/26/2019	5/1/2019	Alternative summary
Alternative ranking, feasibility assessment and selection of recommended alternative	4/26/2019	5/1/2019	Recommendation summary
Preparation of draft report	4/26/2019	5/1/2019	Draft Report
Client / Grantee report review	4/26/2019	5/1/2019	Draft Report comments
NHDES report review	5/1/2019	5/20/2019	Draft Report comments
Final project report preparation and submission	5/20/2019	5/31/2019	Final report

3.0 Sources of Secondary Data

3.1 Data Sources

This project will mostly rely on existing data, which will be obtained primarily from Pennichuck Water Works, agencies, institutions, and companies already collecting imagery, resource area mapping and habitat data. Data sources include websites supported by state and federal agencies, available satellite and drone imagery, GIS data and reports from both CEI and PWW, online tools, and field observations. Some of the data sources that have already been identified are summarized in Table 4 and include the following:

Table 4. Secondary Data from Webpage Source or Public Agency

Data Source Title	Source of Data	Website link	Feasibility Criteria	Precision Determination
Satellite Imagery	Google Earth	https://www.google.com/earth/	Dredge operations & environmental impacts	Based on resolution; refer to website for precision.
Information for Planning and Consultation (IPaC) Tool	U.S. Fish and Wildlife Service	https://ecos.fws.gov/ipac/	Dredge operations & environmental impacts	Based on GIS/GPS data; refer to website for precision.
NHB DataCheck Tool	New Hampshire Natural Heritage Bureau	https://www2.des.state.nh.us/nhb_datacheck/	Dredge operations & environmental impacts	Based on GIS/GPS data; refer to website for precision.
Topographic Maps	United States Geological Survey	https://www.usgs.gov/products/maps/topo-maps	Dredge operations & dredge disposal / re-use	Based on survey/GPS equipment; refer to website for precision.

- Archived sediment investigation reports and bathymetric mapping (CEI)
- Drone footage of Harris Pond (CEI)
- Previous records of site field observations from both CEI and PWW
- All sources used in the preliminary reports, *Reservoir Storage Estimates & Tributary and Pond Sediment Accumulation Monitoring* **(**CEI, insert date, see Appendix X) will also be considered for this study.

The following existing project reports and databases contain information already tailored to the interests of this study to answer some of the information above. These include the following:

Table 5. Secondary Data from Previously Completed Report or Database

Data Source Title	Date	Data Source Type	Source of Data	Feasibility Criteria	Precision
Bathymetric Mapping of Harris Pond via simplified sonar methods	2013 - 2018	GIS data layers	CEI	Dredged material quantity and dredge operations	GPS – sub 49 ft WAAS – sub 10 ft Depth capacity of sonar – 2,500 ft
Bathymetric Mapping of Harris Pond via echo-sounding & multi-beam sonar	2011	GIS data layers	Substructure, Inc. / CEI	Dredged material quantity and dredge operations	Horizontal – sub 20 cm Vertical – sub 0.5 m
Water level gaging data	On-going	Excel database	PWW	Dredge operations & water supply operations & environmental impacts	Based on staff gauge gradations; nearest tenths of foot.
Supply pond raw water intake consumption	On-going	Excel database	PWW	Dredge operations & water supply operations	Based on water treatment plant meter gradation
Harris Pond Dredging Sediment Chemical Analysis Report	August 2018	Laboratory Report	ChemServe	Dredged material quality & dredge disposal / re-use	Based on laboratory equipment; refer to QA/QC report
Bowers & Harris Pond Sediment Analysis Study	August 2013	Previous Report	CEI	Dredged material quantity and quality	Horizontal based on GPS equipment – sub 6 in Vertical is based on survey rod – sub 1/10 ft
Reservoir Storage Estimates & Tributary and Pond Sediment Accumulation Monitoring.	December 2017	Previous Report	CEI	Dredged material quantity and dredge operations	GPS – sub 49 ft WAAS – sub 10 ft Depth capacity of sonar – 2,500 ft

Once the data sources for the dredging feasibility study have been collected and reviewed, a draft memo will be prepared which will summarize the various data sources, the validation required, the modification required, the relevance and whether the information can be used for determining feasibility. The evaluation tree shown in Figure 4 will be utilized to review data. If the sources can be used, they will be broken up into the criteria categories listed above and then used and cited to assess dredging locations, site access, staging areas, dredged material characteristics and potential environmental impact areas, etc.

This data evaluation memo will summarize data availability and quality, study objectives, and indicators for pertinence or relevance to the feasibility criteria needed to evaluate dredge options. All data sources will be fully referenced, including links to online tools and programs, and any documentation of data quality.

3.2 Data Generators

Data generators are, generally speaking, the agencies, research institutions, and other organizations that collect (or have collected) suitable (in terms of type of data being relevant to PWW's goals) environmental data covering an adequate geographic scale, and being of adequate quality.

CEI and PWW have collaborated on many projects within the Pennichuck water supply watershed since

2000. As previously noted, the body of data and information that has been gathered as a result of these various projects will be valuable when analyzing the Harris Pond area of the Pennichuck Brook watershed. As such, both CEI and PWW will be considered data generators for the purposes of this study.

Additional data generators, such as those mentioned in Section 3.1, will be selected based on the quality and availability of their data within published reports, online sources, or other readily available sources of data.

3.3 Hierarchy of Data Sources

In general, priority data will be obtained from the following, provided that these data sources have documented and adequate quality control and quality assurance procedures:

- Recent or ongoing Pennichuck Brook watershed study projects.
- Studies performed or data collected by trusted agencies or research institutions.

If the above conditions are not met, less desirable data may be gathered if they can provide useful insight regarding conditions found in the forested area surrounding Harris Pond. Any limitations and gaps in data included in the report will be fully disclosed, and it will be noted that the data should be used with appropriate caution. For example, data obtained from the USFWS National Wetland Inventory does not provide permit-level information (i.e., wetland delineation) regarding the presence of wetlands on site, but is still useful as a screening tool for large sites that can be supplemented with additional field investigations. Even if data are not of the best quality, they may represent the best available knowledge of the study area and be helpful in developing recommendations for additional field investigations to eliminate critical data gaps in future phases of the project (e.g., prior to dredging design and permitting).

3.4 Rationale for Selecting Data Sources

Given the specificity of this study's data needs (i.e., recent, localized land cover and habitat information for the Harris Pond ecosystem), in many cases there may only be one data source available. If multiple data sources are available, they will all be evaluated and the highest quality, most complete (in terms of up-to-date spatial coverage and resolution) data source will be used.

3.5 List of Sources of Secondary Data

The sources of all secondary data presented within this study will be identified in any report or other project deliverables, either in the body of the document or its associated appendices. Any online resources will be provided in the form of web links for further consultation by any interested parties. Full references to the data will be listed, along with references to data quality.

4.0 Quality of Secondary Data

4.1 Quality Requirements

Data should meet the following quality requirements. However, given the scarcity of environmental data

within our specific study area for some indicators, it is likely that some datasets will not meet one or more requirements. These data may still be valuable for the purposes of the study. If such data are used, any data gaps will be noted. Data quality requirements are as listed below.

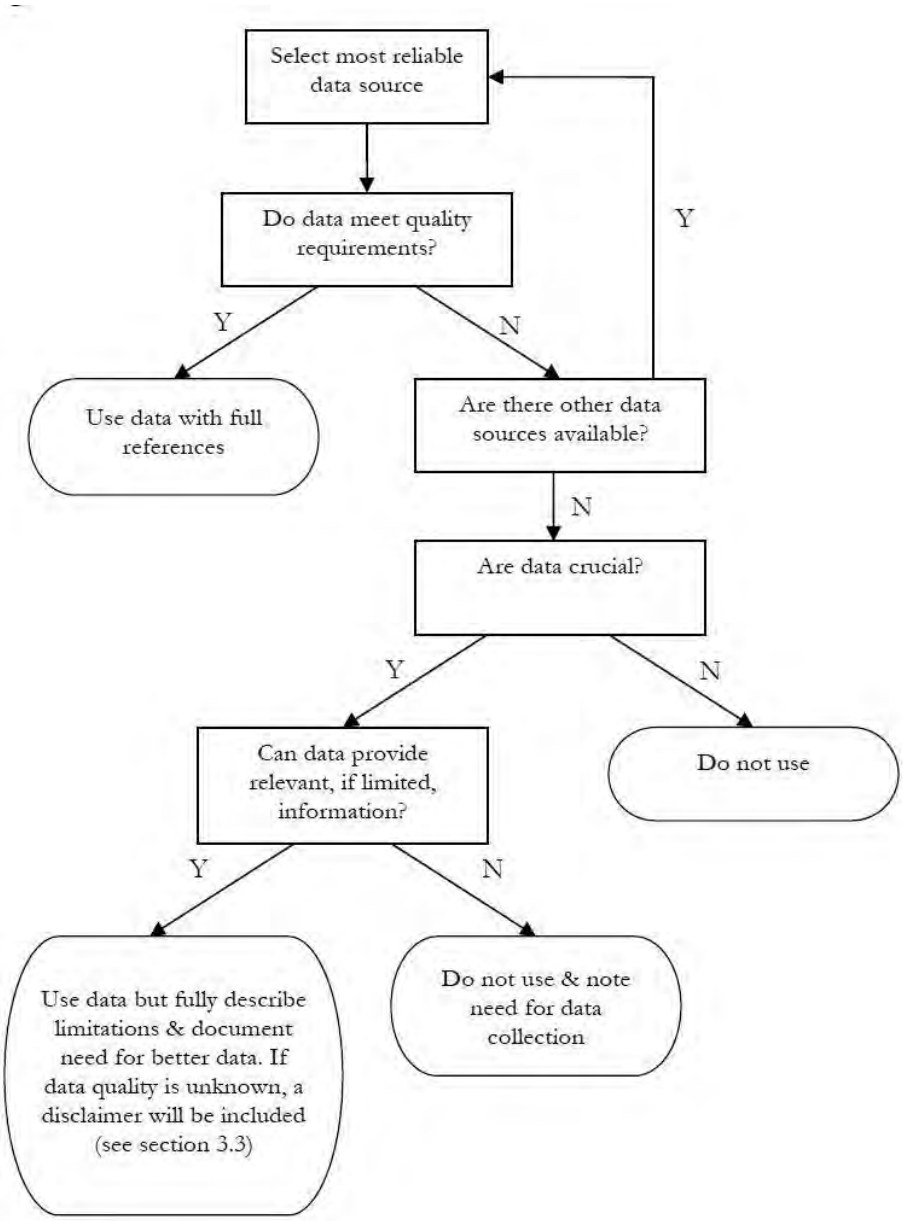
- The data has been generated by a reliable source. Although the identity of the data generator does not guarantee data quality, it provides a simple screening criterion when multiple data sources are available. The following are indicators of data source reliability:
  - The data generator is generally trusted and respected federal, state, or research institutions; examples include, but are not limited to, U.S. EPA, Google Earth, U.S. Fish and Wildlife Service)
  - The data generator uses documented quality assurance procedures. The data evaluators will first evaluate the source of data (e.g. website) to confirm that they are a trusted and respected federal, state, or research institution. Data evaluators for this project will review materials produced by data generators for quality assurance and note the results in a memorandum.
  - Data is produced by trusted scientific consulting companies that utilize quality assurance procedures. Data are published in peer-reviewed articles or publications.
- Data have been collected for similar purposes; i.e., to assess the status and trends in a particular environmental indicator
- Data have been collected by trained personnel familiar with the appropriate standard operating procedures
- Completeness
  - Spatial coverage
- Data provides good coverage of the geographic area of interest (e.g., as much of the forest surrounding Harris Pond as possible is represented)
- Data are more or less evenly distributed over time. In other words, there are no major periods where no data were collected
- Data are recent, ideally recorded within the last decade

NHDES may implement, at their discretion, various audits or reviews of this project to assess conformance and compliance to the quality assurance project plan in accordance with standard protocols.

4.2 Data Review and Evaluation

The quality of the secondary data will be determined according to the decision tree shown in **Figure 4** and based on data quality requirements defined in Section 4.1. In determining data quality, the completeness of the data will be assessed first, by inspecting data description (usually metadata) or the data itself—whichever is more easily available. If completeness is deemed adequate, other quality requirements will be assessed by inspecting the QAPP, other QA/QC documentation, metadata, and/or other information obtained from data providers.

Figure 4. Data Evaluation Decision Tree



4.3 Disclaimers

All project deliverables will inform of the existence of this QAPP. As stated previously, any limitations in data quality will be fully disclosed. If a decision is made to use data of unknown quality, this will be indicated in a disclaimer that will be added to any project deliverable. The disclaimer will read: "These data are of unknown quality and presented here for illustrative purposes only. No inferences regarding the state of the natural resources or habitats surrounding Harris Pond should be made based on these data until their quality can be determined."

5.0 Data Reporting, Data Reduction, Data Validation, and Records Management

5.1 Data Reduction

In general, data will be manipulated as little as possible. Data reduction may be required to isolate relevant environmental indicators in order to more definitively deduce the feasibility of dredging Harris Pond.

The following are some examples of anticipated or possible data sources that may need reduction and the reduction methods with evaluation procedures (provided that adequate data are available):

- GIS Layers of Bathymetric Mapping – bathymetric contours will be manipulated using ArcGIS Spatial Analyst extension tool that will trim the contours (z-values) based on elevation to estimate a volume of sediment between the bathymetric layer and the selected elevation. This will assist in calculating volume of sediment at different locations and depths based on bathymetric mapping.
- PWW Historic Database of Raw Water Consumption – Data in Excel format will be "trimmed" and averaged based on time periods when dredging could occur to estimate potential water consumption from the supply ponds to select optimal potential dredging time frames while minimizing operational impacts during times of higher water demand. Cells in Excel databases will be selected to take averages based on the selected dredge time frame.
- PWW Historic Database of Harris Pond Water Level Gaging - Data in Excel format will be "trimmed" and averaged based on time periods when dredging could occur to estimate average water levels which could occur during potential dredging time frames. Cells in Excel databases will be selected to take averages based on the selected dredge time frame.

5.2 Data Validation

The reporting of accurate project data will generally be ensured by carefully conducting and clearly expressing data reduction (if and when needed) and visual inspection of data before including it in the final report. Specifically:

- A copy of every original dataset or datum from each data source will be saved as a read-only, protected file in the event the integrity of the working datasets is compromised
- Working data will be stored in the relevant format and will include all relevant raw data, which will be locked for editing
- Data manipulation will be minimized to decrease the chances of inadvertently introducing errors. If any data reduction or manipulation is needed, it will occur starting from the raw, protected data.

Based on the conceptual level of this feasibility study the secondary data used will sufficient to estimate sediment quantity and dredging procedures for the purposes of cost estimation and identification of future design, permitting, and construction logistics. Data gaps are anticipated only for sediment quality and reuse/disposal options. These data gaps will addressed if the project moves forward with design and permitting following evaluation of feasibility results. At that time, sampling frequency and protocol will be developed based appropriate state and local guidance to characterize sediment quality.

5.3 Deliverables

The deliverables of this project will consist of one draft letter report which will be submitted to PWW and NHDES for review and comment. Comments on the draft report will be tracked and any required revisions will be incorporated into a final report. Following PWW and NHDES review, the final report and associated site plans/maps and support data will be prepared. The final report and maps and support data will be produced by CEI for PWW, and it is expected that decisions regarding the potential future dredging of Harris Pond will be informed by the final project deliverables. A final report deliverable will be submitted to PWW and NHDES for their records and to document grant completion.

5.4 Records Management

The following project-related documents and records will be kept by CEI for a minimum of three years from the date of the final report

- Original files and materials (either electronic or in print) obtained from the data providers, including imagery, data quality reports, and other relevant information pertaining to the data and data interpretation
- Draft and final versions of the report
- Minutes from any meeting held in relation with the preparation of the report
- List of report reviewers and their written comments
- Files exchanged with any clients or subcontractors involved with the project
- Other relevant documents or materials

6.0 References

Comprehensive Environmental, Inc. 2017. *Reservoir Storage Estimates & Tributary and Pond Sediment Accumulation Monitoring.* December 2017. A report to Pennichuck Water Works, Merrimack, NH.

Comprehensive Environmental, Inc. 2013. *Bowers and Harris Pond Sediment Analysis Study.* August 2013. A report to Pennichuck Water Works, Merrimack, NH.

APPENDIX A

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REVISION NOTE:

Document #8812, effective 2-1-07, readopted with amendments and redesignated former Chapter Env-Wm 1600 titled Standards for Reporting and Remediation of Oil Discharges as Env-Or 600 pursuant to a rules reorganization plan for Department rules approved by the Director of the Office of Legislative Services on 9-7-05.

The prior filings for former Env-Wm 1600 include the following document:

#8198, eff 11-3-04

CHAPTER Env-Or 600 CONTAMINATED SITE MANAGEMENT

Statutory Authority: RSA 146-A:11-c, IV, V, & V-a; RSA 146-C:9, X & XI; RSA 147-A:3, VII; RSA 147-F:18, I(b) & (h); RSA 485:3-b, I; RSA 485-C:4, III, VIII, IX, & X; RSA 541-A:16, I(b)

PART Env-Or 601 PURPOSE AND APPLICABILITY

Env-Or 601.01 Purpose. The purpose of these rules is to establish:

(a) Procedures and requirements for the investigation, management, and remediation of contamination from the discharge of regulated contaminants that adversely affect human health or the environment resulting from human operations or activities;

(b) Procedures to obtain a groundwater management permit as required by RSA 485-C;

(c) Procedures to restrict future property use pursuant to RSA 147-F:15;

(d) Procedures and requirements for notification of, and emergency and initial response actions in response to, a discharge of a regulated contaminant; and

(e) Procedures for determining fees for expedited reviews of environmental site assessment reports pursuant to RSA 485:3-b, I.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

Env-Or 601.02 Applicability. This chapter shall apply to:

(a) All environmental investigations and remediation of discharges of regulated contaminants identified in this chapter, including oil, whether conducted pursuant to RSA 146-A, RSA 146-C, RSA 147-A, RSA 147-B, RSA 147-F, or RSA 485-C;

(b) Groundwater management zones and groundwater management permits;

(c) The procedures for the notification of discharges of regulated contaminants identified in this chapter, including oil;

(d) Emergency and initial response actions conducted in response to a discharge of any regulated contaminant identified in this chapter, including oil; and

(e) Requests for expedited review of environmental site assessment reports pursuant to RSA 485:3-b, I.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

PART Env-Or 602 DEFINITIONS

Env-Or 602.01 "Activity and use restriction (AUR)" means controls imposed at a site, to achieve or maintain a condition that is protective of human health and the environment, which is recorded in the registry of deeds for the county in which the site is located.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.02 "Ambient groundwater quality standards (AGQS)" means "ambient groundwater quality standards" as defined in RSA 485-C:2, I, as reprinted in Appendix C.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.03 "Background" means the concentration of a chemical in the environment that would exist at a site in the absence of a discharge, including chemicals that are ubiquitous and consistently present at or in the vicinity of the site such as:

(a) Coal or wood ash associated with fill material;

(b) Petroleum residues that are incidental to the normal operation of motor vehicles;

(c) Asphalt pavement and petroleum compounds contained in associated sub-base materials;

(d) Fertilizers that were applied in a manner consistent with their labeling; and

(e) Pesticides that were applied in a manner consistent with their labeling.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.04 "Certificate of completion" means a certificate issued by the department which certifies that:

(a) The activities specified in an approved remedial action have been completed;

(b) Any necessary activity and use restrictions have been implemented;

(c) Any monitoring requirements are being met; and

(d) All fees and costs due under RSA 146-A, RSA 146-C, RSA 147-A, RSA 147-B, and RSA 147-F have been paid.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.05 "Certificate of no further action" means a certificate issued by the department which certifies that:

(a) No further investigation, remediation, or other actions are required;

(b) Any necessary activity and use restrictions have been implemented;

(c) Any monitoring requirements necessary to implement an activity and use restriction are being met; and

(d) All fees and costs due under RSA 146-A, RSA 146-C, RSA 147-A, RSA 147-B, and RSA 147-F have been paid.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.06 "Chemical Abstract Service Number (CAS No.)" means the unique identification number assigned to a particular chemical substance by the Chemical Abstract Registry of the American Chemical Society.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.07 "Contamination" means the presence of any regulated contaminant, as defined herein, other than naturally occurring substances at naturally occurring or background levels, in soil, groundwater, soil gas, air, sediment, surface water, construction/excavation debris, or any other material at a concentration that has the potential to adversely affect human health or the environment.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.08 "Department" means the New Hampshire department of environmental services.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.09 "Discharge" means the release or addition of any regulated contaminant to land, groundwater, or surface water.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 602.10 "Engineer of record" means "engineer of record" as defined in RSA 310-A:2, III, as reprinted in Appendix C.

Source. #10831, eff 6-1-15

Env-Or 602.11 "Groundwater" means "groundwater" as defined in RSA 485-C:2, VIII, as reprinted in Appendix C.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.10)

Env-Or 602.12 "Groundwater contamination" means a violation of the groundwater quality criteria specified in Env-Or 603.01.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.11)

Env-Or 602.13 "Groundwater management permit" means a permit issued pursuant to RSA 485-C:4, VIII and Env-Or 607 to a site owner or responsible party to establish a groundwater management zone, manage the use of contaminated groundwater, and monitor remedial progress.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.12)

Env-Or 602.14 "Groundwater management zone (GMZ)" means:

(a) Subject to (b), below, the subsurface volume in which groundwater contamination associated with a discharge is contained; or

(b) For unlined solid waste landfills with no groundwater contamination, the subsurface volume beneath the area delineated by the property boundary.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.13)

Env-Or 602.15 "Initial site characterization" means a preliminary assessment following a discharge that is performed to collect information regarding the subsurface conditions of a site, the extent of the discharge, and potential receptors in the area.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.14)

Env-Or 602.16 "Natural attenuation" means a reduction in the mass, toxicity, mobility, volume, or concentration of contaminants by physical, chemical, or biological processes without human intervention.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15(from Env-Or 602.12) (from Env-Or 602.15)

Env-Or 602.17 "Non-aqueous phase liquid (NAPL)" means a liquid, containing any contaminant, that is immiscible or only partially miscible in water and exists as a separate phase.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.16)

Env-Or 602.18 "Oil" means "oil" as defined in RSA 146-A:2, III, as reprinted in Appendix C.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.17)

Env-Or 602.19 "Person" means any individual, partnership, company, public or private corporation, political subdivision or agency of the state, department, agency or instrumentality of the United States of America, or any other legal entity.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.18)

Env-Or 602.20 "Point of contact (POC)" means a person designated by a group of responsible parties to file reports and receive notices on behalf of all of the responsible parties.

Source. #10831, eff 6-1-15

Env-Or 602.21 "Potential receptor" means a living organism or an environmental medium that is in the pathway of contamination from a discharge.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.19)

Env-Or 602.22 "Potentiometric surface map" means a map of the hydraulic head in an aquifer.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.20)

Env-Or 602.23 "Presumptive remedy" means a technology or process used to remediate a particular type of contamination, which in other applications has been cost-effective based on historical performance data for sites with similar hydrogeological characteristics and is protective of human health and the environment.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.21)

Env-Or 602.24 "Professional of record" means the professional engineer or professional geologist licensed under RSA 310-A who is responsible for the documents.

Source. #10831, eff 6-1-15

Env-Or 602.25 "Receptor" means a living organism or an environmental medium that is exposed to contamination from a discharge.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.22)

Env-Or 602.26 "Regulated contaminant" means "regulated contaminant" as defined in RSA 485-C:2, XIII, as reprinted in Appendix C.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.23)

Env-Or 602.27 "Remedial action" means any measure or combination of measures that will, when implemented, ensure attainment of a level of control of contaminants such that no contaminant will adversely affect human health or the environment.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.24)

Env-Or 602.28 "Remedial action plan" means proposed actions to:

(a) Remove, treat, or contain contamination sources;

(b) Mitigate indoor air contamination;

(c) Contain contaminated groundwater within the limits of a groundwater management zone;

(d) Restore groundwater quality to meet groundwater quality criteria of Env-Or 603.01; and

(e) Restore soil quality to meet soil remediation criteria of Env-Or 606.19.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.25)

Env-Or 602.29 "Responsible party" means any person subject to the strict liability provisions of RSA 146-A:3-a, RSA 147-A:9, RSA 146-C:11, or RSA 147-B:10. For any site where there is more than one responsible party, the term includes all responsible parties or the point of contact, as applicable from the context of the rule where the term is used.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.26)

Env-Or 602.30 "Signature" means the name, mark, symbol, sound, or digital or electronic logical association affixed to a record to attest to its validity.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.27)

Env-Or 602.31 "Site" means a place or location where a discharge is known or suspected to have occurred and includes the full extent of contamination resulting from the discharge.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.28)

Env-Or 602.32 "Site investigation" means an investigation of a discharge at a site and the off-site surrounding area, that is performed to determine the location and full extent of contamination and identify receptors and potential receptors.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.29)

Env-Or 602.33 "Soil" means any unconsolidated material above bedrock, regardless of particle size, produced by the physical and chemical disintegration of bedrock and that might contain organic matter. Soil does not include sediment found in surface water.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.30)

Env-Or 602.34 "Surface water" means "surface water" as defined in RSA 146-A:2, VI-b, as reprinted in Appendix C.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.31)

Env-Or 602.35 "Water supply well" means a well that serves as a drinking water supply, including any well serving a public water system as defined in RSA 485:1-a, XV.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.32)

Env-Or 602.36 "Writing" means any intentional reduction to tangible form including letters, words, or numbers, or their equivalent, set down by handwriting, typewriting, photostating, photographing, magnetic impulse, mechanical or electrical recording, or other form of data compilation.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 602.33)

PART Env-Or 603 GROUNDWATER QUALITY CRITERIA

Env-Or 603.01 Groundwater Quality Criteria. Unless exempt under Env-Or 603.02, the following criteria shall apply to all groundwaters of the state:

(a) Groundwater shall be suitable for use as drinking water without treatment;

(b) Groundwater shall not contain any regulated contaminant at a concentration greater than the ambient groundwater quality standards in Env-Or 603.03; and

(c) Groundwater shall not contain any regulated contaminant at a concentration such that the natural discharge of that groundwater to surface water will cause a violation of a surface water quality standard established in Env-Wq 1700.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 603.02 Exemptions to Groundwater Quality Criteria. Groundwater quality shall be exempt from the groundwater quality criteria of Env-Or 603.01 if:

(a) The groundwater is within a groundwater discharge zone permitted in accordance with Env-Wq 402;

(b) The groundwater is within a groundwater management zone permitted in accordance with Env-Or 607;

(c) The groundwater is contaminated solely with salt and other de-icing chemicals applied for winter road maintenance;

(d) The groundwater contamination resulted from backwash from a public water treatment facility that is subject to Env-Wq 402; or

(e) The groundwater contamination is not the result of human operations or activities.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 603.03 Ambient Groundwater Quality Standards (AGQS).

(a) Pursuant to RSA 485-C:6, ambient groundwater quality standards (AGQS) shall apply to all regulated contaminants that result from human operations or activities.

(b) The following shall apply to Table 600-1, below:

(1) The standard for total trihalomethanes, namely bromoform, bromodichloromethane, dibromochloromethane and trichloromethane (chloroform), shall be 80 micrograms per liter (µg/L) if the groundwater is contaminated by chlorinated water supplies;

(2) If perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are both present, the standard shall be a combined total of 0.07 µg/L;

(3) Positives for total coliform shall be confirmed by the presence of other wastewater parameters, such as fecal coliform, Escherichia coli, fecal streptococcus, nitrates, and chlorides;

(4) Unless otherwise noted, concentrations shall be measured in micrograms per liter (µg/L), which is equivalent to parts per billion (ppb); and

(5) Gross alpha radionuclides, radium 226 and 228, strontium 90, and tritium shall be measured in picocuries per liter (pCi/L).

(c) AGQS shall be as set forth in Table 600-1 below:

Table 600-1 AMBIENT GROUNDWATER QUALITY STANDARDS		
Chemical Name	**CAS No.**	**AGQS µg/L (ppb)**
Acenaphthene	83-32-9	420
Acenaphthylene	208-96-8	420
Acetone	67-64-1	6,000
Acrylonitrile	107-13-1	5
Alachor	15972-60-8	2
Aldicarb	116-06-3	7
Aldicarb sulfone	1646-88-4	7
Aldicarb sulfoxide	1646-87-3	7
Aldrin	309-00-2	0.1
Allyl chloride	107-05-1	7.4
Anthracene	120-12-7	2,100
Antimony	7440-36-0	6
Arsenic	7440-38-2	10
Atrazine	1912-24-9	3
Barium	7440-39-3	2,000
Benzene	71-43-2	5
Benzidine	92-87-5	0.8
Benzo(a)anthracene	56-55-3	0.1
Benzo(a)pyrene	50-32-8	0.2
Benzo(b)fluoranthene	205-99-2	0.1
Benzo(g,h,i)perylene	191-24-2	210
Benzoic Acid	65-85-0	28,000
Benzo(k)fluoranthene	207-08-9	0.5
Beryllium	7440-41-7	4
Biphenyl, 1,1-	92-52-4	350
bis-(2-chloroethyl)ether	111-44-4	10
bis-(2-chloroisopropyl)ether	39638-32-9	300
bis-(chloromethyl)ether	542-88-1	10
Bisphenol A	80-05-7	120
Bromobenzene	108-86-1	60
Boron	7440-42-8	620
Bromodichloromethane	75-27-4	0.6
Bromoform	75-25-2	4
Bromomethane	74-83-9	10
Butylbenzene, n-	104-51-8	260
Butylbenzene, sec-	135-98-8	260
Butylbenzene, tert	98-06-6	260
Cadmium	7440-43-9	5
Camphor	76-22-2	50
Carbofuran	1563-66-2	40
Carbon disulfide	75-15-0	70
Carbon tetrachloride	56-23-5	5
Chlordane	57-74-9	2
Chloroaniline, p-	106-47-8	28

Table 600-1 AMBIENT GROUNDWATER QUALITY STANDARDS		
Chemical Name	**CAS No.**	**AGQS µg/L (ppb)**
Chloromethane	74-87-3	30
Chlorophenol, 2-	95-57-8	35
Chlorotoluene	95-49-8	100
Chlorotrifluoroethylene (CFC 1113)	79-38-9	5
Chromium (Total)	7440-47-3	100
Chrysene	218-01-9	5
Clopyralid (Stinger 3SC)	1702-17-6	3500
Copper	7440-50-8	1300
Cyanide	57-12-5	200
Cyanazine(Bladex 4L/90DF)	21725-46-2	1
2,4-D (Dichlorophenoxy acetic acid, 2,4-)	94-75-7	70
Dalapon	75-99-0	200
DDD (Dichlorodiphenyl dichloroethane, p,p')	72-54-8	0.1
DDE (Dichlorodiphenyl dichloroethylene, p,p')	72-55-9	0.1
DDT (Dichlorodiphenyl trichloroethane, p,p')	50-29-3	0.1
Dibenzo(a,h)anthracene	53-70-3	0.1
Dibromochloromethane	124-48-1	60
Dibromochloropropane	96-12-8	0.2
Dibutylphthalate	84-74-2	800
Dichlorobenzene, 1,2- (o-DCB)	95-50-1	600
Dichlorobenzene, 1,3- (m-DCB)	541-73-1	600
Dichlorobenzene, 1,4- (p-DCB)	106-46-7	75
Dichlorobenzidine, 3,3'-	91-94-1	1.3
Dichlorodifluoromethane	75-71-8	1,000
Dichloroethane, 1,1-	75-34-3	81
Dichloroethane, 1,2-	107-06-2	5
Dichloroethylene, 1,1-	75-35-4	7
Dichloroethylene, cis-1,2-	156-59-2	70
Dichloroethylene, trans-1,2-	156-60-5	100
Dichloromethane (Methylene chloride)	75-09-2	5
Dichlorophenol, 2,4-	120-83-2	21
Dichloropropane, 1,2-	78-87-5	5
Dichloropropene, 1,3-	542-75-6	0.5
Dieldrin	60-57-1	0.1
Diethyl ether	60-29-7	1,400
Di(ethylhexyl)adipate	103-23-1	400
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	6
Diisopropyl ether (DIPE)	108-20-3	120
Dimethyl phthalate	131-11-3	50,000
Dimethylphenol, 2,4-	105-67-9	140
Dinitrophenol, 2,4-	51-28-5	14
Dinitrotoluene, 2,4-	121-14-2	10
Dinoseb	88-85-7	7
Dioxane, 1,4-	123-91-1	3
Diphenylhydrazine, 1,2-	122-66-7	10

Table 600-1 AMBIENT GROUNDWATER QUALITY STANDARDS		
Chemical Name	**CAS No.**	**AGQS µg/L (ppb)**
Diquat	85-00-7	20
Endosulfan	115-29-7	42
Endothall	145-73-3	100
Endrin	72-20-8	2
Ethylbenzene	100-41-4	700
Ethylene dibromide	106-93-4	0.05
Ethylene glycol	107-21-1	7,000
Ethyl tertiary-butyl ether (ETBE)	637-92-3	40
Fluoranthene	206-44-0	280
Fluorene	86-73-7	280
Fluoride	16984-48-8	4,000
Formaldehyde	50-00-0	100
Glyphosate	1071-83-6	700
Gross alpha radionuclides		15 pCi/L
Heptachlor	76-44-8	0.4
Heptachlor epoxide	1024-57-3	0.2
Hexachlorobenzene	118-74-1	1
Hexachlorobutadiene	87-68-3	0.5
Hexachlorocyclohexane, alpha	319-84-6	0.03
Hexachlorocyclohexane, beta	319-85-7	0.1
Hexachlorocyclohexane, gamma (Lindane)	58-89-9	0.2
Hexachlorocyclopentadiene	77-47-4	50
Hexachlorodibenzodioxin, 2,3,7,8	34465-46-8	0.0221
Hexachloroethane	67-72-1	1
Indeno(1,2,3-cd)pyrene	193-39-5	0.1
Isophorone	78-59-1	100
Isopropyl benzene	98-82-8	800
Isopropyltoluene, p-	99-87-6	260
Lead	7439-92-1	15
Manganese	7439-96-5	840
Mercury	7439-97-6	2
Methanol	67-56-1	4,000
Methoxychlor	72-43-5	40
Methyl ethyl ketone (MEK)	78-93-3	4,000
Methyl isobutyl ketone (MIBK)	108-10-1	2,000
Methylnaphthalene, 1-	90-12-0	160
Methylnaphthalene, 2-	91-57-6	280
Methyl phenol, 2- (o-cresol)	95-48-7	40
Methyl phenol, 4- (p-cresol)	106-44-5	40
Methyl tertiary-butyl ether (MtBE)	1634-04-4	13
Metolachlor (Dual 8E/25G)	51218-45-2	70
Metribuzin (Sencor 75DF)	21087-64-9	100
Monochlorobenzene (Chlorobenzene)	108-90-7	100
Naphthalene	91-20-3	20
Nickel	7440-02-0	100
Nitrate	14797-55-8	10,000

Table 600-1 AMBIENT GROUNDWATER QUALITY STANDARDS		
Chemical Name	**CAS No.**	**AGQS µg/L (ppb)**
Nitrite	14797-65-0	1,000
Oxamyl	23135-22-0	200
Pentachlorophenol	87-86-5	1
Perfluorooctanoic Acid (PFOA), total of all isomers	335-67-1	0.07
Perfluorooctane Sulfonate (PFOS), total of all isomers	1763-23-1	0.07
Phenanthrene	85-01-8	210
Phenol	108-95-2	4,000
Picloram	1918-02-1	500
Polychlorinated biphenyls (PCBs)	1336-36-3	0.5
Potassium	7440-09-7	160,000
n-Propylbenzene	103-65-1	260
Pyrene	129-00-0	210
Radium 226 and 228	7740-14-4	5 pCi/L
Selenium	7782-49-2	50
Silver	7440-22-4	100
Simazine	122-34-9	4
Strontium 90	10098-97-2	8 pCi/L
Styrene	100-42-5	100
Sulfate	14808-79-8	500,000
TCDD, 2,3,7,8- (Dioxin)	1746-01-6	0.00003
Tertiary amyl methyl ether (TAME)	994-05-8	140
Tertiary butyl alcohol (TBA)	75-65-0	40
Tetrachloroethane, 1,1,1,2-	630-20-6	70
Tetrachloroethane, 1,1,2,2,-	79-34-5	2
Tetrachloroethylene (PCE)	127-18-4	5
Tetrachlorophenol, 2,3,4,6	58-90-2	200
Tetrahydrofuran	109-99-9	600
Thallium	7440-28-0	2
Toluene	108-88-3	1,000
Total Coliform	-	CTS/100ml
Toxaphene	8001-35-2	3
2,4,5-TP (Silvex)	93-72-1	50
Trichlorobenzene, 1,2,4-	120-82-1	70
Trichlorobenzene, 1,3,5-	108-70-3	40
Trichloroethane, 1,1,1-	71-55-6	200
Trichloroethane, 1,1,2-	79-00-5	5
Trichloroethylene (TCE)	79-01-6	5
Trichlorofluoromethane	75-69-4	2,000
Trichloromethane (Chloroform)	67-66-3	70
Trichlorophenol, 2,4,5-	95-95-4	700
Trichlorophenol, 2,4,6-	88-06-2	5
Trichloropropane, 1,2,3-	96-18-4	0.5
Trimethylbenzene, 1,2,4-	95-63-6	330
Trimethylbenzene, 1,3,5-	108-67-8	330

Table 600-1 AMBIENT GROUNDWATER QUALITY STANDARDS		
Chemical Name	**CAS No.**	**AGQS µg/L (ppb)**
Tritium	10028-17-8	20,000 pCi/L
Vinyl chloride	75-01-4	2
Xylenes (mixed isomers)	1330-20-7	10,000

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; amd by #9213, eff 7-23-08; ss by #10831, eff 6-1-15; amd by #11112, EMERGENCY RULE, eff 5-31-16, EXPIRES: 11-27-16; amd by #12008, eff 10-22-16

PART Env-Or 604 NOTIFICATION

Env-Or 604.01 Purpose. The purposes of this part are to identify those circumstances in which a responsible party or other person is required to notify the department and to set forth the procedures for such notification.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.02 Notification of Groundwater Quality Violation.

(a) Unless exempted under Env-Or 604.03, the responsible party shall notify the department no more than 60 days after obtaining knowledge of a violation of the groundwater quality criteria of Env-Or 603.01.

(b) Any person required to notify the department pursuant to (a), above, shall provide notification to the department in writing, including as much of the following information as is available at the time of notification:

(1) The name, daytime telephone number, and email address, if any, of the individual notifying the department;

(2) The location of the site;

(3) The nature and location of the violation;

(4) The name, daytime telephone number, and email address, if any, of each responsible party, and if there is more than one responsible party, the name, daytime telephone number, and email address, if any, of a point of contact;

(5) The proximity of the violation to receptors and potential receptors including water supply wells and surface water; and

(6) All available reports and sampling results related to the discovery of the violation.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.03 Exemptions to Notification of Groundwater Quality Violation. The following shall be exempt from the notification requirements of Env-Or 604.02:

(a) The permittee and, if different, the owner of a facility with a groundwater release detection permit, provided the permittee reports as required by Env-Or 700;

(b) The owner of a public water supply, provided the groundwater quality violation is discovered through testing required by rules in subtitle Env-Dw and the person reports as required by Env-Dw 800; and

(c) The permittee and, if different, the owner of a facility with a groundwater discharge permit, provided the permittee reports as required by Env-Wq 402.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.04 Discharges of Hazardous Waste. Any person required to report under RSA 147-A:11 shall notify the department in accordance with RSA 147-A and Env-Hw 100 et seq.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.05 NAPL Notification.

(a) The responsible party shall notify the department either orally or in writing immediately after obtaining knowledge of the detection of non-aqueous phase liquid (NAPL) of greater than 1/8 inch in thickness on groundwater unless the NAPL is being managed in accordance with the following:

(1) An emergency or initial response action conducted pursuant to Env-Or 605.03 or Env-Or 605.04;

(2) A remedial action plan approved pursuant to Env-Or 606.10; or

(3) A groundwater management permit issued pursuant to Env-Or 607.

(b) The responsible party required by (a), above, to notify the department shall provide as much of the following information as is available at the time of notification:

(1) The name, daytime telephone number, and email address, if any, of the individual notifying the department;

(2) The location of the discharge site including the department site identification number;

(3) The type and thickness of the NAPL layer observed; and

(4) A description of proposed NAPL recovery actions.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.06 Discharges of Oil Requiring Immediate Notification. The responsible party or other person who becomes aware of an oil discharge shall notify the department immediately after obtaining knowledge that a discharge meeting one or more of the following criteria has occurred:

(a) A discharge of any oil into surface water or groundwater of the state;

(b) A discharge of 25 gallons or more of oil to land;

(c) A discharge of less than 25 gallons of oil to land, unless the discharge is cleaned up immediately and properly disposed of;

(d) A discharge of oil that results in the presence of vapors that pose an imminent threat to human health;

(e) A discharge of oil resulting in a violation of the groundwater quality criteria of Env-Or 603.01 in a sample collected from a water supply well; or

(f) A discharge of oil resulting in the detection of NAPL.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.07 Potential Discharges of Oil Requiring Notification Within 60 Days. The responsible party or other person who becomes aware of a potential discharge of oil based on an exceedance of the soil remediation standards of Env-Or 606.19 that might have been caused by an oil discharge shall notify the department no more than 60 days after obtaining knowledge of the exceedance.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 604.08 Oil Notification Requirements. A person required to notify the department of a discharge of oil pursuant to Env-Or 604.06, or a potential discharge of oil pursuant to Env-Or 604.07 based on an exceedance of the soil remediation standards, shall provide notification to the department either orally or in writing, including as much of the following information as is available at the time of notification:

(a) The name, daytime telephone number, and email address, if any, of the individual notifying the department;

(b) The location of the discharge site;

(c) The date and time of the discharge;

(d) The type and amount of oil discharged;

(e) The name, daytime telephone number, and email address, if any, of each responsible party, and if there is more than one responsible party, the name, daytime telephone number, and email address, if any, of a POC;

(f) The proximity of the discharge to receptors and potential receptors including water supply wells and surface water;

(g) The name, mailing address, daytime telephone number, and email address, if any, of the contractor hired to clean up the contamination;

(h) A description of any emergency or initial response actions that have been taken or are proposed to be taken;

(i) The names of other federal, state, or local government agencies that have been notified or that have responded to the discharge, or both;

(j) The cause of the incident and the method used that detected the discharge; and

(k) All available reports and sampling results related to the discharge.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 605 PRELIMINARY RESPONSE ACTIONS

Env-Or 605.01 Purpose. The purpose of this part is to:

(a) Describe the nature and extent of preliminary response actions that are required following a:

(1) Discharge;

(2) Potential discharge of oil based on an exceedance of the soil remediation standards; or

(3) Groundwater quality violation; and

(b) Prescribe standards and procedures for conducting emergency response actions, initial response actions, and initial site characterizations.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.02 Emergency or Immediate Response Actions for Hazardous Waste Discharges. The responsible party shall conduct emergency or immediate response actions for any hazardous waste discharge in accordance with RSA 147-A and Env-Hw 100 et seq.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.03 Emergency Response Actions for Oil Discharges.

(a) The responsible party shall initiate an emergency response action as soon as practicable to prevent, eliminate, or minimize damage to human health and the environment from any discharge of oil.

(b) The responsible party shall conduct an emergency response action at any site where:

(1) A discharge of oil has created or might create hazardous or explosive vapors;

(2) A discharge of oil has caused the contamination of any private or public water supply well;

(3) A discharge of oil has caused a sheen on surface water;

(4) A discharge of oil has caused oil to enter a storm drain or sanitary sewer;

(5) NAPL from a discharge of oil is detected; and

(6) The department determines and notifies the responsible party that emergency response actions are necessary to prevent, eliminate, or minimize damage to human health and the environment from a discharge of oil.

(c) The responsible party shall conduct an emergency response action that:

(1) Assesses and evaluates fire, health, and safety hazards;

(2) Stops the discharge;

(3) Contains the discharge;

(4) Cleans up and disposes of discharged oil and contaminated debris in accordance with all local, state, and federal regulations;

(5) Protects potential receptors from contamination; and

(6) Stabilizes the site to protect human health and the environment.

(d) An emergency response action shall include such assessments, containment measures, or removal actions as are consistent with the purposes of emergency response actions as identified in (c), above, or otherwise necessary to prevent, eliminate, or minimize damage to human health and the environment, as applicable, such as:

(1) Discharge containment measures;

(2) Vapor abatement measures;

(3) Drainage controls;

(4) Providing potable water;

(5) NAPL recovery;

(6) Disposal of oil or contaminated debris;

(7) Soil excavation and disposal; and

(8) Collection and analysis of soil, sediment, surface water, groundwater, soil gas, or indoor air samples.

(e) The responsible party shall notify the department and others of the emergency response action in accordance with Env-Or 604 and Env-Or 610.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.04 Initial Response Actions.

(a) The responsible party shall conduct an initial response action at a site following a discharge or groundwater quality violation in order to:

(1) Reduce risks to human health and the environment; and

(2) Reduce potential future costs of response actions by remediating or containing contamination until such a time as a more comprehensive response action conducted in accordance with Env-Or 606 can be implemented.

(b) An initial response action shall include such assessments, containment measures, or removal actions as are consistent with the purpose of an initial response action as identified in (a), above, or otherwise necessary to prevent, eliminate, or minimize damage to human health and the environment, as applicable, such as:

(1) NAPL recovery;

(2) Groundwater treatment and recovery;

(3) Soil excavation and disposal;

(4) Soil vapor extraction;

(5) Receptor surveys;

(6) Vapor abatement measures; and

(7) Collection and analysis of soil, sediment, surface water, groundwater, soil gas, or indoor air samples.

(c) The responsible party shall notify the department and others of the initial response action in accordance with Env-Or 604 and Env-Or 610.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.05 Emergency and Initial Response Action Approval.

(a) The responsible party shall submit a work scope describing a proposed emergency or initial response action to the department for approval prior to implementation except as provided for in (c), below.

(b) The department shall approve a work scope for an emergency or initial response action if it is consistent with the applicable provisions of Env-Or 605.03 and Env-Or 605.04.

(c) In order to minimize contamination, reduce risk of exposure, or promote more timely response actions, the responsible party may begin emergency or initial response actions at a site before the work scope is submitted to or approved by the department, provided the responsible party:

(1) Notifies the department either verbally or in writing of the proposed activities to be conducted prior to beginning the response actions;

(2) Incorporates the self-initiated measures into the report submitted to the department pursuant to Env-Or 605.06 below; and

(3) Complies with the requirements of all other applicable local, state, and federal rules and statutes.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.06 Emergency and Initial Response Action Reporting Requirements.

(a) The responsible party shall submit a written report to the department within 30 days of completing an emergency response action or an initial response action.

(b) The report shall include the following information:

(1) The site owner's name, mailing address, daytime telephone number, and email address, if any;

(2) The name, mailing address, daytime telephone number, and email address, if any, of each responsible party, and if there is more than one responsible party, the name, mailing address, daytime telephone number, and email address, if any, of a POC;

(3) The name, mailing address, telephone number, and email address, if any, of each consultant and contractor hired to conduct the response action;

(4) Identification of potential receptors;

(5) The type and quantity of the discharge;

(6) A description of response actions conducted;

(7) Disposal documentation including copies of bills of lading and manifests;

(8) Copies of laboratory analytical data;

(9) A site sketch showing the location of the discharge in relation to site buildings and site boundaries; and

(10) A summary of findings.

(c) Where response actions continue for longer than 120 days, the responsible party shall submit an interim response action report every 60 days that contains the information specified in (b), above, for that reporting period.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.07 Initial Site Characterization Required. The department shall send a written request for an initial site characterization to the responsible party following receipt of notice under Env-Or 604 unless:

(a) The department determines, based on preliminary response actions, that the site meets the no further action criteria of Env-Or 609.02; or

(b) The department determines that a site investigation in accordance with Env-Or 606.01 is required to adequately characterize the nature and extent of the discharge, based on a review of any response actions taken, the type and extent of contamination, and risk to receptors.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.08 Initial Site Characterization.

(a) The responsible party shall perform an initial site characterization if requested by the department pursuant to Env-Or 605.07.

(b) The responsible party shall submit a report of the initial site characterization required in (a), above, to the department within 60 days of a department request for an initial site characterization.

(c) The initial site characterization shall:

(1) Determine the source, location, and estimated quantity of the discharge and any response actions taken;

(2) Determine the nature and extent of contamination encountered; and

(3) Identify nearby receptors and potential receptors.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.09 Initial Site Characterization Report. The initial site characterization report shall include the following:

(a) Site information including:

(1) The department site identification number;

(2) The site name and address;

(3) The name, mailing address, daytime telephone number, and email address, if any, of the site owner and of a contact person for the site;

(4) A description of all known discharges of regulated contaminants at the site;

(5) A description of all response actions conducted at the site;

(6) A description of site use at the time of the discharge; and

(7) A site sketch that includes the following:

a. The location of the discharge;

b. The location of site buildings;

c. The location of site underground utilities; and

d. The approximate site boundaries;

(b) A summary of groundwater, soil, surface water, soil gas, indoor air, and water supply well sampling data, as appropriate;

(c) A copy of test pit logs, borings logs, and monitoring well construction details;

(d) A preliminary assessment of receptors and potential receptors located within 500 feet of the site including:

(1) Drinking water supply wells including owner's name and mailing address; and

(2) Surface water bodies;

(e) A copy of any reports or sampling data relating to the discharge if not already on file with the department; and

(f) A summary of findings.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 605.10 Investigation Due to Discovery of Discharges from Unknown Sources. When a discharge from an unknown source is discovered adjacent to a facility as defined in RSA 146-A:2, IX or RSA 146-C:1, V, the owner of such facility shall conduct an initial site characterization in accordance with Env-Or 605.07.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 606 COMPREHENSIVE RESPONSE ACTIONS

Env-Or 606.01 Site Investigation Required.

(a) The responsible party shall perform a site investigation following a discharge or groundwater quality violation if so requested by the department pursuant to Env-Or 606.02.

(b) The site investigation shall:

(1) Determine the source, nature, location, and full extent of contamination;

(2) Identify receptors and potential receptors; and

(3) Identify the need to conduct further investigation or remedial actions.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.02 Site Investigation Request; Exemptions. The department shall send a written request for a site investigation to the responsible party after receipt of notice under Env-Or 604 unless:

(a) The department determines that an initial site characterization will be adequate to define the nature and extent of contamination based on a review of any response actions taken, the type and extent of contamination, and risk to receptors; or

(b) The site meets the no further action criteria of Env-Or 609.02.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.03 Site Investigation Report.

(a) The responsible party shall submit a report of the site investigation required by Env-Or 606.01 to the department for approval within 120 days of a department request for a site investigation.

(b) The site investigation report shall include the following:

(1) The site background information identified in Env-Or 606.04;

(2) The summary of subsurface explorations and sampling identified in Env-Or 606.05;

(3) The description of the site's geology and hydrology identified in Env-Or 606.06;

(4) The conceptual model identified in Env-Or 606.07;

(5) The remedial alternatives, recommendations, and summaries identified in Env-Or 606.08; and

(6) The appendices identified in Env-Or 606.09.

(c) The site investigation report shall be dated, signed, and sealed by the professional of record.

(d) The department shall accept the site investigation report upon determining that the report contains all information required by (b), above.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.04 Site Background Information. The site investigation report shall include the following site background information:

(a) The department site identification number;

(b) The site name, address, property deed reference by county book and page, and property tax map and lot numbers;

(c) The name, mailing address, and daytime telephone number of the site owner and of a contact person for the site;

(d) A history of site ownership and operation based on documented land use, in accordance with "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process", ASTM International (ASTM) document ASTM E 1527-05 or ASTM E 1527-13 (ASTM E 1527), available as noted in Appendix B;

(e) Copies of historical site plans and Sanborn Fire Insurance maps for the site, where available;

(f) A list of any aerial photographs reviewed, including the date and source for each photograph and a description of observations;

(g) A description of possible past or present contamination sources such as the following:

(1) Underground or above ground storage tank systems including pumps, piping, and appurtenances;

(2) Dry wells and floor drains including discharge locations, if known;

(3) Areas of stained soil or stressed or dead vegetation;

(4) Landfills;

(5) Lagoons;

(6) Septic systems;

(7) Areas of surface discharges or spills;

(8) Drum storage areas;

(9) Areas used to store, treat, or dispose of hazardous wastes or hazardous substances;

(10) Stockpiled soils;

(11) Buried drum areas; and

(12) Herbicide and pesticide use, storage or disposal areas;

(h) A description of all known discharges of regulated contaminants, including the following information:

(1) The date and a description of the discharge, including estimated quantities lost and recovered, the location of the discharge, and the party responsible for the discharge; and

(2) The date the discharge was reported to the department, if reported; and

(3) A description of all response actions taken;

(i) A list of any previous investigations and reports pertinent to the site relating to a discharge of regulated contaminants, including a brief summary of findings;

(j) A copy of any previous investigation or report relating to a discharge of regulated contaminants, if not already on file with the department;

(k) A list of governmental records reviewed relating to discharges at the site;

(l) A locus plan using a color photocopy of a U.S. Geological Survey (USGS) map, 7-1/2 minute series if available, which clearly identifies the site location;

(m) A site plan drawn to scale on an 8-1/2 inches by 11 inches or 11 inches by 17 inches sheet, that includes the following:

(1) A title, a legend, and a true north arrow;

(2) A graphic scale bar;

(3) Source(s) from which the site plan was derived, if applicable;

(4) The location, elevation, and datum of a permanent and recoverable bench mark;

(5) Surface topography using ground spot elevations, contours, or noted changes in slope;

(6) The location of the site's property boundaries;

(7) The areas of known and possible contaminant sources past or present on the site including but not limited to current or former possible sources listed in (g)(1)-(12), above;

(8) Any paved areas on the site;

(9) Monitoring wells, test pits and borings; and

(10) Identification of the following on and within 100 feet of the site:

a. Surface water bodies;

b. Water supply wells;

c. Surface water sampling stations;

d. Structures and buildings;

e. Drainage swales; and

f. Potential preferential migration pathways including but not limited to underground utilities; and

(n) Any additional information including the source(s) from which the site background information was obtained.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by

#10831, eff 6-1-15

Env-Or 606.05 Summary of Subsurface Explorations and Sampling. The site investigation report shall include a summary of subsurface explorations and sampling conducted at the site and off-site surrounding area including:

(a) A description of test pits, borings, monitoring wells, and well development activities;

(b) A description of water table elevation observations, organic vapor analyzer results, and odors noted;

(c) A copy of the site plan showing the orientation of the graphical geologic cross section(s) and the location of test pits, borings, monitoring wells, and other sources of geologic information for the site;

(d) Groundwater, soil, air, soil gas, sediment, surface water, and water supply well sampling data, as applicable, including:

(1) Sampling methodologies;

(2) For all monitoring wells, surface water sampling points, and water supply wells where contamination has been detected, analytical results for a minimum of 2 sets of samples collected at least 2 weeks apart; and

(3) At sites where groundwater contamination has been detected, samples collected from water supply wells at risk;

(e) One or more tables that summarize all current groundwater, soil, surface water, and water supply well analytical data including:

(1) Sample locations;

(2) Sample dates;

(3) Chemicals detected including the analytical detection limits;

(4) Chemical concentrations; and

(5) Chemicals that exceed regulatory limits;

(f) One or more tables that summarize historic groundwater, soil, surface water, and water supply well analytical data including:

(1) Sample locations;

(2) Sample dates; and

(3) Chemical concentrations; and

(g) A description of all other methods used to evaluate subsurface conditions as appropriate, such as:

(1) Geophysical methods;

(2) Geochemical analyses;

(3) Cone penetrometer; and

(4) Fracture trace and photo lineament analysis.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.06 Site Geology and Hydrology. The site investigation report shall include a description of the geology and hydrogeology of the site including:

(a) Groundwater potentiometric surface(s), hydraulic gradients, flow direction, hydraulic conductivity, and seepage velocity;

(b) Soil types, distribution, and permeability;

(c) When encountered and drilled, bedrock type and characteristics, including depths and contours;

(d) Geologic cross-sections to describe the geology and hydrogeology of the site including the following:

(1) One cross-section parallel to groundwater flow and one cross-section perpendicular to groundwater flow;

(2) The horizontal and vertical scale of each cross-section;

(3) Approximate ground surface elevations and inferred elevation of contacts between the major geologic units;

(4) A complete textural description of the major soil and bedrock units, with geologic interpretation, such as fill, till, stratified drift, weathered bedrock;

(5) The location of all data sources, including soil borings, monitoring wells, test pits, and bedrock cores upon which the geologic interpretations are based;

(6) The line of section referenced to an appropriate site plan;

(7) The offset distance for all data points not located directly on the line of section;

(8) The screened interval of all groundwater monitor wells and piezometers, with measured water level or potentiometric surface elevations;

(9) The surveyed elevations of any surface water features intercepted by the line of section; and

(10) Contaminant concentrations at each data point indicated on the cross-section;

(e) A table of groundwater elevation data including:

(1) Groundwater elevations;

(2) Top of well casing elevations surveyed to the benchmark required under Env-Or 606.04(m)(4);

(3) Measured depth to water table from top of casing;

(4) If NAPL is present, measured depth to NAPL from top of casing; and

(5) If NAPL is present, NAPL thickness;

(f) A potentiometric surface map indicating the groundwater flow direction; and

(g) Any other information that is necessary to describe the geology and hydrogeology of the site.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.07 Conceptual Model. The site investigation report shall include a conceptual model that includes:

(a) A narrative description supported by the technical illustrations required pursuant to (b), below, that describes the occurrence and movement of groundwater and contaminants at the site including transport mechanisms, migration, and degradation pathways;

(b) Technical illustrations of the nature and extent of contamination including the following:

(1) A groundwater contaminant concentration contour map(s), prepared using the site plan prepared pursuant to Env-Or 606.04(m) as a base map, that depicts:

a. The lateral distribution of groundwater contamination; and

b. The predominant contamination characteristics;

(2) A soil contaminant concentration contour map(s), prepared using the site plan prepared pursuant to Env-Or 606.04(m) as a base map, that depicts:

a. The lateral extent of soil contamination; and

b. The predominant contamination characteristics;

(3) A contaminant distribution map(s), prepared using the cross-sections prepared pursuant to Env-Or 606.06(d) as a base map, that depicts:

a. The vertical extent of soil and groundwater contamination; and

b. The predominant contamination characteristics;

(c) An estimate of the amount of contaminant mass at the site;

(d) A potential receptor map, prepared using a tax map as a base map, that identifies and locates, to the extent ascertainable, the following listed items located within 1,000 feet of the site:

(1) Streets;

(2) Properties, including tax map and lot number, ownership, and land use;

(3) Surface water;

(4) Locations where potentially sensitive human subpopulations exist such as daycare centers, schools, playgrounds, parks, senior housing; and

(5) Water supply wells including tax map and lot number and owner's name and mailing address for each well;

(e) A list of water supply wells sampled pursuant to Env-Or 606.05(d)(3), including for each well:

(1) The owner's name, mailing address, tax map and lot number; and

(2) The type of well construction and well depth to the extent ascertainable; and

(f) A preliminary groundwater management zone delineated in accordance with Env-Or 607.05.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.08 Remedial Alternatives, Summary, and Recommendations. The site investigation report shall include a preliminary screening of remedial alternatives, a summary, and recommendations including:

(a) A preliminary screening of remedial alternatives that identifies remedial action alternatives that meet the criteria of Env-Or 606.13;

(b) A summary of the following:

(1) Site conditions;

(2) Subsurface explorations;

(3) Conceptual model including contaminant distribution; and

(4) Receptors and potential receptors; and

(c) Recommendations, including a discussion of proposed corrective action activities, that include one or more of the following as appropriate:

(1) Interim response actions to abate immediate risks to human health and the environment;

(2) Periodic sampling;

(3) Additional site investigation work;

(4) Remedial action; or

(5) No further action.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.09 Appendices. The site investigation report shall include the following in appendices:

(a) Color photographs showing key site features;

(b) A description of the field procedures used including methods for installing monitoring wells and borings and collecting soil, soil gas, groundwater, drinking water, and air samples;

(c) Field screening data;

(d) Boring logs and monitoring well construction details including but not limited to the following:

(1) Soil sample descriptions;

(2) Drilling methods;

(3) Water table observations;

(4) Odors observed; and

(5) Organic vapor analyzer results;

(e) Analytical laboratory data including chain of custody forms and holding times; and

(f) Detailed calculations and summary of data used for supplemental analysis, if any.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.10 Remedial Action Plan.

(a) A responsible party required to conduct a site investigation under Env-Or 606.01 shall prepare a remedial action plan unless exempted under Env-Or 606.11.

(b) The responsible party shall submit a report of the remedial action plan required in (a), above, to the department within 120 days following written notice from the department that a remedial action plan is required under (a), above.

(c) The remedial action plan report shall be dated, signed, and sealed by the engineer of record.

(d) The remedial action plan shall:

(1) Provide for protection of human health and the environment;

(2) Provide a detailed evaluation of remedial alternatives pursuant to Env-Or 606.12(c) with justification for the recommended alternative;

(3) Recommend action to:

a. Remove or treat the source of contamination;

b. Contain the contamination source to limit the impact to groundwater, surface water, and soil to the extent feasible;

c. Protect human health from exposure through the indoor air exposure pathway;

d. Protect human health from exposure through the direct contact exposure pathway;

e. Contain contaminated groundwater within the limits of a proposed groundwater management zone, delineated in accordance with Env-Or 607.05;

f. Restore groundwater quality to the groundwater quality criteria specified in Env-Or 603.01; and

g. Restore soil quality to the soil remediation criteria specified in Env-Or 606.19; and

(4) Provide for financial assurance pursuant to Env-Or 606.20 and Env-Or 606.21, as applicable.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.11 Remedial Action Plan Exemptions. Unless otherwise required by statute, a remedial action plan shall not be required where:

(a) The site meets the no further action criteria of Env-Or 609.02;

(b) The department determines, based on the site investigation, that there is no remaining source of contamination at the site and there are no impacts to receptors; or

(c) A presumptive remedy is selected that will meet the criteria of Env-Or 606.13 and is agreed to by each responsible party and the department.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.12 Remedial Action Plan Report. The remedial action plan report shall include the following:

(a) A brief summary of site investigation work completed to date including a description of the current site conceptual model that includes at a minimum the information described in Env-Or 606.07;

(b) A description of any other information collected during the site investigation that supports the selected remedy for the site;

(c) An evaluation of a minimum of 2 remedial alternatives, or combination of alternatives, that includes an assessment of:

(1) Effectiveness and reliability;

(2) Feasibility and ease of implementation;

(3) Risk reduction and associated benefits;

(4) Cost effectiveness using the net present worth of all future costs; and

(5) Estimated time to reach the no further action criteria pursuant to the requirements of Env-Or 609.02;

(d) Justification for the recommended alternative;

(e) For the recommended alternative, the following information, as applicable:

(1) A site map drawn to scale on an 8-1/2 inches by 11 inches or 11 inches by 17 inches sheet, using the site plan prepared pursuant to Env-Or 606.04(m) as a base map, and showing:

a. The system layout and areas of influence for a treatment system; or

b. The lateral extent of a source removal project;

(2) A preliminary process flow diagram showing major system components and controls;

(3) Final and interim contaminant reduction performance standards including a proposed schedule with target dates;

(4) Recommendations for conducting any additional investigations, pilot tests, or bench scale studies before proceeding with final design and construction of the recommended alternative;

(5) A description of the methodology for evaluating the performance of the recommended alternative, including monitoring locations and frequency;

(6) A schedule for submitting the periodic status reports required pursuant to Env-Or 606.15(d);

(7) A schedule for implementing the recommended alternative;

(8) A list of federal, state, and local permits required to implement the recommended alternative;

(9) A description of any activity and use restrictions being proposed at the site including a proposed self-certification schedule; and

(10) A description of the proposed financial assurance mechanisms as specified in Env-Or 606.20 and Env-Or 606.21;

(f) Recommendations to provide potable water to receptors when a water supply well no longer meets the groundwater quality criteria of Env-Or 603.01; and

(g) The proposed delineation of the groundwater management zone overlaid on a tax map that complies with Env-Or 607.05.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.13 Remedial Action Plan Approval. The department shall approve the remedial action plan upon determining that:

(a) Human health and the environment will be protected;

(b) The groundwater quality criteria specified in Env-Or 603.01 will be met;

(c) Sources of contamination will be controlled to reduce or eliminate further discharges;

(d) Contaminated soil will be removed, treated, or contained to reduce the human health risk associated with direct exposure via dermal contact, ingestion, and inhalation;

(e) The risk to human health and the environment will be reduced to the greatest extent practicable, balancing costs and benefits by evaluating the risk to human health and the environment by the methods described in the ASTM E 2081-00 (2010)e1 entitled "Standard Guide for Risk Based Corrective Action" (ASTM E 2081), available as noted in Appendix B;

(f) Long-term management, including operation and maintenance of the remediation equipment and site monitoring requirements, will be minimized;

(g) The potential need for modification of the remedy will be minimized;

(h) Resource value of groundwater impacted by the contamination will be protected to the greatest extent practicable taking into account current and anticipated future land use;

(i) Long-term institutional and engineering controls will be reliable; and

(j) Financial assurance as required by Env-Or 606.20 and Env-Or 606.21 will be available.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.14 Corrective Action Prior to Remedial Action Plan Approval. In order to minimize contamination, reduce risk of exposure, or promote more timely remediation, the responsible party may begin remediation at a site before a remedial action plan is submitted to or approved by the department, provided the responsible party:

(a) Notifies the department in writing of the proposed activities to be conducted prior to beginning remediation;

(b) Incorporates the self-initiated remediation measures into the remedial action plan that is submitted to the department for approval; and

(c) Complies with all other applicable local, state, and federal requirements.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.15 Remedial Action Implementation.

(a) If the approved remedial action does not include any active on-site treatment system, containment system, or source removal project, the responsible party shall initiate implementation of the approved remedial action within 90 days following the department's approval of the remedial action.

(b) If the approved remedial action includes any active on-site treatment system, containment system, or source removal project, the responsible party shall:

(1) Submit design plans and construction specifications to the department prepared pursuant to Env-Or 606.16 for the active on-site treatment system or source removal project, as applicable, within 90 days following department approval of the remedial action; and

(2) Initiate implementation of the approved remedial action within 90 days following department approval of the design plans and construction specifications.

(c) The responsible party shall submit a remedial action implementation report prepared pursuant to Env-Or 606.17 to the department within 90 days following completion of remedial action implementation activities.

(d) The responsible party shall submit periodic status reports prepared pursuant to Env-Or 606.18 to the department to monitor the effectiveness of remedial action implementation activities at the frequency specified in the department-approved remedial action.

(e) If implementation of the approved remedial action fails to meet performance standards specified in the approved remedial action, the responsible party shall:

(1) Notify the department in writing; and

(2) Submit recommendations for revising the remedial action, including a schedule of milestones, to the department for approval.

(f) The department shall approve the revised remedial action if the revised proposal meets the requirements of Env-Or 606.13 and addresses the reason(s) why the original remedial action did not meet the performance standards specified.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; amd by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

Env-Or 606.16 Design Plans and Construction Specifications.

(a) The design plans and construction specifications required pursuant to Env-Or 606.15(b) shall include the following, as applicable:

(1) A description of the purpose and function of the remedial treatment system or source removal project;

(2) A list of applicable design criteria for the remedial treatment system or source removal project including, but not limited to:

a. Site limitations;

b. Physical properties of the soil and aquifer;

c. Space restrictions;

d. Subsurface obstacles, barriers, or both;

e. Noise restrictions;

f. Air and water discharge permit requirements;

g. Remedial treatment system flow rates; and

h. Remedial treatment system efficiency;

(3) Remedial treatment system performance standards;

(4) Characteristics, quantities, and locations of environmental media and contaminants to be treated or removed;

(5) Expected waste products that will be generated and their means of disposal;

(6) Pilot test results used in the preparation of the design; and

(7) Manufacturer's data describing the equipment in the design.

(b) Construction plans and specifications required pursuant to Env-Or 606.15(b) shall provide sufficient detail for construction of the remedial system or source removal project.

(c) The design plans and construction specifications prepared pursuant to this section shall be dated, signed, and sealed by the engineer of record.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.17 Remedial Action Implementation Report.

(a) The remedial action implementation report required pursuant to Env-Or 606.15(c) shall include the following:

(1) As-built drawings indicating any changes from the original design documents;

(2) The results of any testing or measurements made during remedial action implementation activities;

(3) A description of remedial action implementation activities including tables and figures; and

(4) Transportation and disposal documentation for any remediation waste transported off-site, including:

a. Free product;

b. Spent carbon;

c. Contaminated groundwater; and

d. Contaminated soils.

(b) The remedial action implementation report prepared pursuant to (a), above, shall be dated, signed, and sealed by the professional of record.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.18 Periodic Status Report.

(a) Each periodic status report required pursuant to Env-Or 606.15(d) shall include the following:

(1) A summary of work performed during the period including a description of the type and frequency of monitoring activities conducted;

(2) A review of the site conceptual model noting any changes;

(3) A tabular and graphical summary of groundwater quality and treatment system monitoring data showing trends in contaminant concentrations, including cumulative mass of contaminant removed by the treatment system;

(4) An evaluation of operation and maintenance requirements, and recommendations for modifications, adjustments, or upgrades, if any; and

(5) An evaluation of progress towards meeting performance standards including any recommendations for remedial action revisions.

(b) The periodic status reports prepared pursuant to (a), above, shall be dated, signed, and sealed by the professional of record.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.19 Soil Remediation Criteria.

(a) Soil remediation standards shall apply to all contaminated soil resulting from a discharge except as provided for in (c) through (f), below.

(b) Soil remediation standards shall be as set forth in Table 600-2 below:

Table 600-2
SOIL REMEDIATION STANDARDS

Chemical Name	CAS No.	Concentration (mg/kg)
Acenaphthene	83-32-9	340
Acenaphthylene	208-96-8	490
Acetone	67-64-1	75
Acrylonitrile	107-13-1	0.5
Alachor	15972-60-8	0.2
Aldicarb	116-06-3	0.1
Aldicarb sulfone	1646-88-4	0.1
Aldicarb sulfoxide	1646-87-3	0.2
Aldrin	309-00-2	0.09
Allyl chloride	107-05-1	1
Anthracene	120-12-7	1,000
Antimony	7440-36-0	9
Arsenic	7440-38-2	11
Atrazine	1912-24-9	0.09
Barium	7440-39-3	1000
Benzene	71-43-2	0.3
Benzidine	92-87-5	0.01
Benzo(a)anthracene	56-55-3	1
Benzo(a)pyrene	50-32-8	0.7
Benzo(b)fluoranthene	205-99-2	1
Benzoic acid	65-85-0	350
Benzo(k)fluoranthene	207-08-9	12
Beryllium	7440-41-7	12
Biphenyl, 1,1-	92-52-4	125
Bis (2Chloroisopropyl) ether	108-60-1	5
Bis (Chloroethyl) ether	111-44-4	0.7
Bisphenol A	80-05-7	1,300
Boron	7440-42-8	1,000
Bromodichloromethane	75-27-4	0.1
Bromoform	75-25-2	0.1
Bromomethane	74-83-9	0.3
Butylbenzene, n-	104-51-8	110
Butylbenzene, sec-	135-98-8	130

Table 600-2
SOIL REMEDIATION STANDARDS

Chemical Name	CAS No.	Concentration (mg/kg)
Butylbenzene, tert-	98-06-6	100
Cadmium	7440-43-9	33
Carbofuran	1563-66-2	0.6
Carbon disulfide	75-15-0	460
Carbon tetrachloride	56-23-5	12
Chlordane	57-74-9	4
Chloroaniline, p-	106-47-8	1.3
Chloromethane	74-87-3	3
Chlorophenol, 2-	95-57-8	2
Chlorotoluene, 2 (o)	95-49-8	15
Chlorotoluene, 4 (p)	106-43-4	680
Chromium (III)	16065-83-1	1,000
Chromium (VI)	18540-29-9	130
Chrysene	218-01-9	120
Cyanazine	21725-46-2	0.03
Cyanide	57-12-5	22
2,4-D (Dichlorophenooxy acetic acid, 2,4-)	94-75-7	300
Dalapon	75-99-0	3
DDD (Dichlorodiphenyl dichloroethane, p,p')	72-54-8	6
DDE (Dichlorodiphenyl dichloroethylene, p,p')	72-55-9	4
DDT (Dichlorodiphenyl trichloroethane, p,p')	50-29-3	4
Dibenzo(a,h)anthracene	53-70-3	0.7
Dibromochloromethane	124-48-1	1
Dibromochloropropane	96-12-8	0.1
Dibutylphthalate	84-74-2	2,600
Dichlorobenzene, 1,2- (o-DCB)	95-50-1	88
Dichlorobenzene, 1,3- (m-DCB)	541-73-1	150
Dichlorobenzene, 1,4- (p-DCB)	106-46-7	7
Dichlorobenzidine, 3,3'-	91-94-1	0.7
Dichlorodifluoromethane	75-71-8	1,000
Dichloroethane, 1,1-	75-34-3	3
Dichloroethane, 1,2-	107-06-2	0.1
Dichloroethylene, 1,1-	75-35-4	14
Dichloroethylene, cis-1,2-	156-59-2	2
Dichloroethylene, trans-1,2-	156-60-5	9
Dichloromethane (Methylene chloride)	75-09-2	0.1
Dichlorophenol, 2,4-	120-83-2	0.7
Dichloropropane, 1,2-	78-87-5	0.1
Dichloropropene, 1,3-	542-75-6	0.1
Dieldrin	60-57-1	0.06
Diethyl ether	60-29-7	3900
Diethyl phthalate	84-66-2	1,000
Di-(2-ethylhexyl)phthalate (DEHP)	117-81-7	72
Diisopropyl ether (DIPE)	108-20-3	10
Dimethyl phthalate	131-11-3	700
Dimethylphenol, 2,4-	105-67-9	4
Dinitrophenol, 2,4-	51-28-5	0.7

Table 600-2
SOIL REMEDIATION STANDARDS

Chemical Name	CAS No.	Concentration (mg/kg)
Dinitrotoluene, 2,4-	121-14-2	0.7
Dinoseb	88-85-7	1
Dioxane, 1,4-	123-91-1	5
Dioxin (2,3,7,8-TCDD equivalents)	1746-01-6	0.001
Diphenylhydrazine, 1,2-	122-66-7	1
Diquat (dibromide)	85-00-7	0.3
Endosulfan	115-29-7	45
Endothall	145-73-3	1
Endrin	72-20-8	8
Ethyl tert butyl ether (ETBE)	637-92-3	0.7
Ethylbenzene	100-41-4	120
Ethylene dibromide	106-93-4	0.1
Ethylene glycol	107-21-1	91
Fluoranthene	206-44-0	960
Fluorene	86-73-7	77
Fluoride	7782-41-4	2200
Formaldehyde	50-00-0	1
Heptachlor	76-44-8	0.2
Heptachlor epoxide	1024-57-3	0.1
Hexachlorobenzene	118-74-1	0.8
Hexachlorobutadiene	87-68-3	17
Hexachlorocyclohexane, alpha	319-84-6	0.06
Hexachlorocyclohexane, beta	319-85-7	0.06
Hexachlorocyclohexane, gamma	58-89-9	0.09
Hexachlorocyclopentadiene	77-47-4	200
Hexachloroethane	67-72-1	0.7
Indeno(1,2,3-cd)pyrene	193-39-5	1
Isophorone	78-59-1	1
Isopropyl benzene	98-82-8	330
Lead	7439-92-1	400
Manganese	7439-96-5	1,000
MCPA (2-Methyl-4-chlorophenoxyacetic acid)	94-74-6	13
MCPP (2-(2- Methyl-4-chlorophenoxy) propionic acid)	93-65-2	26
Mercury (inorganic)	7439-97-6	7
Methanol	67-56-1	50
Methoxychlor	72-43-5	130
Methyl ethyl ketone (MEK)	78-93-3	51
Methyl isobutyl ketone (MIBK)	108-10-1	29
Methyl mercury	22967-92-6	3
Methylnaphthalene, 2-	91-57-6	96
Methyl phenol, 2-	95-48-7	0.9
Methyl phenol, 4-	106-44-5	0.7
Methyl tert butyl ether (MTBE)	1634-04-4	0.2
Metolachlor	51218-45-2	3
Metribuzin	21087-64-9	5
Monochlorobenzene	108-90-7	6
Naphthalene	91-20-3	5

Table 600-2 SOIL REMEDIATION STANDARDS		
Chemical Name	**CAS No.**	**Concentration (mg/kg)**
Nickel	7440-02-0	400
Oxamyl	23135-22-0	2
Pentachlorophenol	87-86-5	3
Phenol	108-95-2	56
Picloram	1918-02-1	6
Polychlorinated Biphenyls (PCBs)	1336-36-3	1
Propyl benzene, n-	103-65-1	85
Pyrene	129-00-0	720
Selenium	7782-49-2	180
Silver	7440-22-4	89
Simazine	122-34-9	0.4
Styrene	100-42-5	17
Tertiary amyl methyl ether (TAME)	994-05-8	3
Tertiary butyl alcohol (TBA)	75-65-0	2
Tetrachloroethane, 1,1,1,2-	630-20-6	0.8
Tetrachloroethane, 1,1,2,2,-	79-34-5	4
Tetrachloroethylene (PCE)	127-18-4	2
Tetrachlorophenol 2,3,4,6	58-90-2	130
Thallium	7440-28-0	10
Toluene	108-88-3	100
Total Petroleum Hydrocarbons		10,000
Toxaphene	8001-35-2	1
2,4,5-TP (Silvex)	93-72-1	60
Trichlorobenzene, 1,2,4-	120-82-1	19
Trichloroethane, 1,1,1-	71-55-6	78
Trichloroethane, 1,1,2-	79-00-5	0.1
Trichloroethylene (TCE)	79-01-6	0.8
Trichlorofluoromethane	75-69-4	1,000
Trichloromethane (Chloroform)	67-66-3	3
Trichlorophenol, 2,4,5-	95-95-4	24
Trichlorophenol, 2,4,6-	88-06-2	0.7
Trichloropropane, 1,2,3-	96-18-4	0.1
Trimethylbenzene, 1,2,4	95-63-6	130
Trimethylbenzene, 1,3,5	108-67-8	96
Vinyl chloride	75-01-4	1
Xylenes (mixed isomers)	1330-20-7	500
Zinc	7440-66-6	1,000

(c) In lieu of the soil standards in Table 600-2, the responsible party may develop site-specific soil remediation standards by evaluating the risk to human health and the environment using the methods described in ASTM Standard E 1739-95 (2010)e1 entitled "Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites" (ASTM E 1739-95), or ASTM E 2081, available as noted in Appendix B, as applicable.

(d) Site-specific soil standards developed pursuant to (c), above, shall:

(1) Demonstrate that leaching of contaminants to groundwater will not result in violations of ambient groundwater quality standards as specified in Env-Or 603.03;

(2) Demonstrate that no significant risk to human health and the environment exists at the site pursuant to the procedures prescribed in ASTM E 1739-95 or ASTM E 2081, as applicable, as noted in (c), above; and

(3) In the evaluation of human health in (2), above, use a cumulative risk approach that compares site-specific information to a cumulative risk of an excess lifetime cancer risk of one in 100,000 and a cumulative non-cancer risk that is a hazard index equal to one pursuant to the procedures prescribed in ASTM E 1739-95 or ASTM E 2081, as applicable, as noted in (c), above.

(e) In lieu of the soil standards in Table 600-2, the responsible party may use an activity and use restriction at a site where a department-approved remedial action relies on the restriction of site activities and uses to eliminate exposure pathways to achieve or maintain protection of human health and the environment pursuant to the procedures outlined in Env-Or 608.

(f) The soil standards in Table 600-2 shall not apply at sites where contamination is at or below background levels.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; amd by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

Env-Or 606.20 Financial Assurance.

(a) If the remedial action plan proposes active remediation or active containment, or both, that will be ongoing for 10 or more years, the responsible party shall establish, implement, and maintain an approved financial assurance plan.

(b) The responsible party shall submit to the department for approval a financial assurance plan within 90 days following approval of the remedial action plan that includes:

(1) A cost estimate prepared in accordance with (c), below;

(2) Provisions for guaranteeing the cost of long-term remediation based on one or any combination of the options specified in Env-Or 606.21; and

(3) For the options specified in Env-Or 606.21(a), the identity of the financial institution providing the guarantee.

(c) The remediation cost estimate shall:

(1) Be itemized and documented to show the unit cost and quantity of each item, service, and activity required for operation and maintenance of the active remediation or active containment system, or both;

(2) Be based on representative current market rates for having a third party perform all required remediation activities;

(3) Be based on the time required to meet the criteria for issuance of a certificate of completion pursuant to Env-Or 609.01 or 30 years, whichever is less;

(4) Include a line item for contingencies equaling no less than 10% of the total itemized costs; and

(5) Be dated, signed, and sealed by the engineer of record.

(d) The responsible party shall demonstrate that it has obtained financial assurance within 30 days of receiving the department's approval of the financial assurance plan.

(e) The responsible party shall submit an update of the remediation cost estimate to the department for approval annually on a date stipulated in the groundwater management permit.

(f) If the updated remediation cost estimate required pursuant to (e), above, is greater than 10% more than the value of the financial assurance mechanism currently in effect, the responsible party shall obtain updated or replacement financial assurance in an amount consistent with the updated remediation cost estimate within 30 days of the department's approval of the cost estimate.

(g) The responsible party shall submit a revised financial assurance plan for department approval within 30 days of learning that any portion of its financial assurance is being cancelled or not renewed by the issuer.

(h) The responsible party shall demonstrate that it has obtained replacement financial assurance promptly upon receiving the department's approval of a revised financial assurance plan, but no later than 30 days before the cancellation or expiration date of the existing financial assurance.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 606.21 Financial Assurance Mechanisms.

(a) Financial assurance required pursuant to Env-Or 606.20(a) shall be provided in one, or any combination, of the following forms:

(1) An irrevocable letter of credit issued for a period of at least one year from an institution whose operations are regulated and examined by a federal or New Hampshire state agency;

(2) An insurance policy, except that insurance issued by an affiliated captive insurance company shall not be acceptable;

(3) A surety bond issued by a surety company listed as an acceptable surety on federal bonds in Circular 570 of the U.S. Department of the Treasury;

(4) A trust fund established in accordance with the laws of the state of New Hampshire; or

(5) An alternate mechanism agreed to by the responsible party and the department that will ensure that the funds necessary to meet the remediation costs are available when they are needed.

(b) If using a surety bond, insurance policy, or letter of credit, the responsible party shall also establish a standby trust to receive the proceeds of the surety bond, insurance policy, or letter of credit.

(c) Each financial assurance instrument specified in (a) and (b), above, shall specifically identify the state of New Hampshire as the beneficiary.

(d) Funds held in trust accounts may be invested, but shall provide for the preservation of principal.

(e) Financial assurance documents shall be as described in 40 CFR 264.151, as applicable.

(f) Letters of credit shall include a provision to automatically extend the expiration date by at least one year unless the issuing institution notifies the responsible party and the department by certified mail, return receipt requested, of a decision to not extend the expiration date at least 120 days before the current expiration date.

(g) Insurance policies and surety bonds shall include a provision to prohibit any cancellation without prior notice of cancellation being sent to the responsible party and the department by certified mail, return receipt requested, at least 120 days before the effective date of cancellation.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 607 GROUNDWATER MANAGEMENT PERMITS

Env-Or 607.01 Groundwater Management Permit Required.

(a) A responsible party shall apply for and obtain a groundwater management permit for any site where:

(1) The discharge of a regulated contaminant at that site has caused and continues to cause the groundwater quality criteria of Env-Or 603.01 to be violated; or

(2) An unlined solid waste landfill regulated pursuant to RSA 149-M is located.

(b) The groundwater management permit shall:

(1) Establish a groundwater management zone (GMZ);

(2) Require implementation of measures to restore groundwater quality within the GMZ to meet groundwater quality criteria of Env-Or 603.01;

(3) Control the use of groundwater within the GMZ;

(4) Require monitoring of the groundwater quality within the GMZ; and

(5) Require an evaluation of the effectiveness of remedial measures.

(c) A groundwater discharge permit issued pursuant to Env-Wq 402 shall not be required for discharges to groundwater associated with an approved remedial action provided a groundwater management permit has been issued for the site.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.02 Groundwater Management Permit Procedures.

(a) An applicant for a groundwater management permit shall obtain a groundwater permit application from the department and submit the completed application to the department:

(1) Within 60 days following department approval of a remedial action plan; or

(2) For cases where a remedial action plan is not required but groundwater quality continues to exceed the groundwater quality criteria specified in Env-Or 603.01, within 60 days of written notice from the department that a groundwater management permit is required pursuant to Env-Or 607.01(a)(1).

(b) The applicant for a groundwater management permit shall:

(1) Also apply for all required local, state, or federal permits;

(2) Provide notification on a form provided by the department by certified mail, return receipt requested, to all owners of properties specified in Env-Or 607.03(a)(20) that their property is proposed for inclusion within the GMZ;

(3) Provide a copy of the complete permit application to the town/city clerk of the municipality in which the site is located;

(4) Obtain rights of access necessary to conduct the approved remedial action;

(5) Obtain any necessary rights as required pursuant to Env-Or 607.06(c) to restrict the use of water wells within the groundwater management zone; and

(6) File documentation of the rights required by (5), above, in the registry of deeds.

(c) The responsible party shall submit the fee required by RSA 485:3-c with the permit application. If paid by check or money order, the instrument shall be made payable to the "Treasurer - State of New Hampshire".

(d) Within 90 days from receipt of a complete permit application, the department shall:

(1) Issue a permit that is valid for a period of 5 years from the date of issuance and subject to renewal; or

(2) Notify the applicant in writing that the information submitted is not sufficient to make a decision and request additional information from the applicant.

(e) If a groundwater management permit is issued, the permit shall contain conditions as are necessary to ensure implementation of the remedial action and monitoring of groundwater quality within the GMZ, including conditions for submitting periodic status reports as required by (f), below.

(f) The permittee shall submit periodic summary reports prepared in accordance with Env-Or 607.04 to summarize the effectiveness of the remedial measures and groundwater quality within the GMZ.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; amd by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

Env-Or 607.03 Groundwater Management Permit Application.

(a) The applicant for a groundwater management permit shall provide the following information on or with a form obtained from the department:

(1) The site name, address, property deed reference by county book and page, and property tax map and lot number, and the department site number;

(2) The name, mailing address, daytime telephone number, and email address, if any, of the site owner;

(3) If different from the site owner, the name, mailing address, daytime telephone number, and email address, if any, of the applicant;

(4) The name, mailing address, daytime telephone number, and email address, if any, of a contact person for the applicant and, if available, a fax number;

(5) A brief summary of the site investigation report;

(6) A brief summary of remedial measures performed to date;

(7) A plan scaled to fit onto an 8-1/2 inches by 11 inches or 11 inches by 17 inches sheet, using a tax map as a base, that identifies and locates to the extent ascertainable, the following:

a. The proposed GMZ boundary;

b. Any deeded easements which restrict the use of the groundwater within the GMZ;

c. Any streets within 1,000 feet of the site;

d. Any properties, including tax map and lot numbers, that are within the proposed GMZ or that abut the lots that are within the proposed GMZ;

e. Any surface water bodies on and within 500 feet of the GMZ;

f. Any lots with water supply wells, including type of use, within 500 feet of the GMZ; and

g. The location, elevation, and datum of a permanent and recoverable bench mark;

(8) A site plan scaled to fit onto an 8-1/2 inches by 11 inches or 11 inches by 17 inches sheet prepared in accordance with Env-Or 606.04(m) that clearly identifies all proposed sampling locations;

(9) A table of current water level measurements obtained from piezometers and monitoring wells used to develop the groundwater contours;

(10) A table summarizing all monitoring results for the 5 years immediately preceding the application, if applicable, from existing monitoring points;

(11) An updated list, including copies if not already submitted to the department, of any previously-completed investigations and reports pertinent to the site;

(12) A summary table, if more than 3 previously-completed investigations and reports are available, that includes the following information:

a. The date of the report;

b. The consultant's name; and

c. The scope of the investigation;

(13) A detailed proposal for a water quality monitoring program, including proposed monitoring schedule, parameters to be analyzed, monitoring locations, and supporting information justifying the locations, frequency and parameters selected;

(14) Well construction details of monitoring wells and elevations of top of wells not previously referenced in the site investigation submitted under Env-Or 606.01;

(15) Certification that application has been made for all required local, state, or federal permits;

(16) Certification that notification has been provided to all owners of lots proposed for inclusion in the GMZ as required by Env-Or 607.02(b)(2);

(17) Certification that a copy of the complete permit application has been provided to the town/city clerk of the municipality as required by Env-Or 607.02(b)(2);

(18) Documentation that rights of access necessary to conduct the approved remedial action have been obtained as required by Env-Or 607.02(b)(3);

(19) Documentation that any necessary rights as required by Env-Or 607.06(c) have been obtained to control the use of water wells within the GMZ and filed in the registry of deeds as required by Env-Or 607.02(b)(5) and (6); and

(20) A list of properties located within the GMZ that includes, for each property:

a. The name and mailing address of the property owner(s) and, if available, a daytime telephone number;

b. The property address;

c. The deed reference, including county book and page; and

d. The tax map and lot number.

(b) The groundwater management permit application shall be dated, signed, and sealed by the professional of record.

(c) The applicant shall sign the application form. Such signature shall constitute certification that all information provided on or with the form or that otherwise is submitted by the applicant as part of the application is true, complete, and not misleading to the knowledge and belief of the signer.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; amd by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

Env-Or 607.04 Periodic Summary Reports.

(a) The periodic summary report required by Env-Or 607.02(f) shall include the following information as applicable:

(1) A summary of work performed during the monitoring period including a description of the type and frequency of monitoring activities conducted;

(2) An update of the site conceptual model, including current groundwater contour and contaminant distribution maps;

(3) A tabular and graphical summary of groundwater quality and treatment system monitoring data showing trends in contaminant concentrations, including the cumulative mass of contaminant removed by the treatment system for the monitoring period;

(4) An evaluation of progress towards meeting performance standards including any recommendations for remedial action revisions; and

(5) A demonstration by the responsible party that the financial assurance requirements of Env-Or 606.20 and Env-Or 606.21 will continue to be available to meet the costs of the approved long-term remediation.

(b) The summary report shall be dated, signed, and sealed by the professional of record.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.05 Establishing the GMZ.

(a) The GMZ boundary delineation shall be supported by hydrogeologic data and include an examination of the following:

(1) The geologic characteristics of the site;

(2) The estimated groundwater flow patterns at the site;

(3) Contaminant transport and degradation mechanisms;

(4) Boundaries by induced hydraulic gradient control;

(5) Natural hydrogeologic boundaries such as groundwater divides or surface water bodies; and

(6) Boundaries created by natural attenuation of contamination.

(b) The boundaries of the GMZ shall be denoted by clearly identifiable physical features or surveyed metes and bounds unless the boundaries coincide with existing property lines.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.06 Monitoring and Use of Groundwater Within a GMZ.

(a) Where drinking water supply wells located within the GMZ are contaminated above the groundwater quality criteria of Env-Or 603.01, the permittee shall provide a potable drinking water supply that meets applicable federal and state water quality criteria.

(b) For water supply wells located within the GMZ that are not contaminated above groundwater quality criteria of Env-Or 603.01, the permittee shall:

(1) Monitor drinking water quality as part of the permit; and

(2) Establish and implement contingency provisions to provide a potable drinking water supply that meets applicable federal and state water quality criteria in the event a well becomes contaminated above the groundwater quality criteria of Env-Or 603.01.

(c) Use of groundwater within the GMZ for drinking water shall be restricted by recorded easement or other form of ownership interest or restriction, except where potable water is available or is provided to all lots of record by the permittee.

(d) Where an undeveloped lot with no drinking water supply is included in the GMZ, the permittee shall contact the property owner annually to determine if a water supply has been developed.

(e) Within 30 days of discovery of a new drinking water supply well within the GMZ, the permittee shall:

(1) Provide written notification of such well to the department that includes the drinking water supply well owners name, mailing address, property tax map and lot number and deed reference by county book and page; and

(2) Sample the supply well, with all sampling, analysis and reporting conducted in accordance with Env-Or 610.02 and Env-Or 610.03.

(f) Groundwater extraction within the GMZ shall be restricted by a recorded easement or other form of ownership interest or restriction if required to implement an approved remedial action.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.07 Groundwater Management Permit Compliance Criteria.

(a) No violation of groundwater quality criteria shall be allowed outside the boundary of the GMZ.

(b) The permittee shall notify the department in writing within 30 days of discovery of a violation of groundwater quality criteria at or beyond the GMZ boundary as evidenced by required permit monitoring.

(c) Within 60 days of discovery of a violation of groundwater quality criteria at or beyond the GMZ boundary, the permittee shall submit recommendations to correct the violation to the department for approval. The department shall approve the recommendations if the department determines that they will correct the violation.

(d) The permittee shall monitor and manage groundwater in compliance with the permit conditions until groundwater contamination sources are eliminated and compliance with groundwater quality criteria is achieved after accounting for seasonal, atmospheric, and hydrogeologic variability.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.08 Permit Notification.

(a) Within 15 days after the department issues the groundwater management permit, the permittee shall provide notice of the permit by certified mail, return receipt requested, to all owners of lots of record within the GMZ.

(b) Within 45 days after the department issues the groundwater management permit, the permittee shall submit documentation of the notification required by (a), above, to the department.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #9213, eff 7-23-08; ss by #10831, eff 6-1-15

Env-Or 607.09 Recordation.

(a) The permittee shall record notice of the permit on a form provided by the department at the appropriate registry of deeds in the chain of title for each lot within the GMZ within 60 days after the department issues the groundwater management permit.

(b) The permittee shall submit a copy of the recorded notice(s) to the department and to the governing body of each municipality in which the site or any lot with the GMZ is located within 30 days of recordation.

(c) The notice of permit shall include the following:

(1) The name and mailing address of the permittee;

(2) The lot owner's name, address, tax map and lot numbers and property deed reference by county book and page numbers;

(3) The permit number and date the permit was approved;

(4) A statement that the permit is available for review at the department; and

(5) A statement that the notice of permit will remain in effect until the department issues a release of recordation.

(d) The permittee shall sign the notice of permit prior to recording it.

(e) The permittee may record one notice that includes all lots or a separate notice for each lot.

(f) The department shall issue a release of recordation to the permittee once groundwater quality within the GMZ meets the groundwater quality criteria of Env-Or 603.01.

(g) The permittee shall record the release of recordation issued pursuant to (e), above, in the registry of deeds in the chain of title for the lot(s) designated in the release within 60 days of receipt of the release of recordation from the department.

(h) Within 30 days of recordation, the permittee shall submit a copy of the recorded release of recordation to the department and to the governing body of each municipality in which the site or any lot with the GMZ is located.

(i) Recordation requirements shall not apply to publicly owned roadways or railroad rights of ways for which there is no chain of title.

(j) The department shall record a release of recordation if the permittee is unwilling or unable to record the release pursuant to (f), above.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.10 Permit Renewal.

(a) The permittee shall apply for a permit renewal prior to its expiration date but no more than 90 days prior to expiration.

(b) The permittee shall continue to comply with all conditions in the current permit until:

(1) The permit is renewed; or

(2) The department issues a certificate of no further action pursuant to Env-Or 609.02.

(c) The applicant for renewal shall provide the following information on a form obtained from the department:

(1) The site name, address, property deed reference by county book and page and property tax map and lot numbers, and the department site number;

(2) The name, mailing address, daytime telephone number, and email address, if any, of the site owner;

(3) If different from site owner, the name, mailing address, daytime telephone number, and email address, if any, of the permittee;

(4) The name, mailing address, and daytime telephone number of the contact person for the site and, if available, a fax number and e-mail address;

(5) A table summarizing all monitoring results for the 5 years immediately preceding the renewal application from existing monitoring points with an assessment of any trends shown by the data;

(6) A summary of remedial measures performed and an update on the performance of measures conducted;

(7) Recommendation for any revisions to the current permit;

(8) A plan(s) scaled to fit onto an 8-1/2 inches by 11 inches or 11 inches by 17 inches sheet, using a tax map as a base, that identifies and locates to the extent ascertainable, the following:

a. The proposed GMZ boundary;

b. Any properties, including tax map and lot numbers, within and abutting the lots on which the proposed GMZ is located;

c. All proposed sampling locations; and

d. Current groundwater contours referenced to a table of current water level measurements obtained from piezometers and monitoring wells used to develop the contours; and

(9) Certification that a copy of the completed permit renewal application has been provided to the town/city clerk of the municipality in which the site is located.

(d) The permit renewal application shall be dated, signed, and sealed by the professional of record.

(e) The applicant shall sign the application form. Such signature shall constitute certification that all information provided on or with the form or that otherwise is submitted by the applicant as part of the application is true, complete, and not misleading to the knowledge and belief of the signer.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.11 Permit Modification.

(a) A permittee who wishes to request a permit modification shall submit a written request to the department that includes:

(1) The reasons for the modification;

(2) A table summarizing all monitoring results to date from existing monitoring points; and

(3) A demonstration that the permit as modified will result in compliance with Env-Or 607.01(b) and Env-Or 607.07.

(b) The department shall modify the permit or deny the request within 90 days of receipt of the request. If the department denies the request, the department shall send the permittee a written notice that states the reason(s) for the denial.

(c) The department shall modify the permit if the applicant can demonstrate that compliance with the permit as modified will result in compliance with Env-Or 607.01(b) and Env-Or 607.07.

(d) The department shall initiate a procedure under RSA 541-A:30 to modify a permit without request by the permittee if the department determines that:

(1) Issuance of the permit was based on false or misleading information and the permit would not have been issued if the information had been true and not misleading;

(2) Modification of the permit is necessary to ensure protection of human health and the environment; or

(3) Modification of the permit is necessary to ensure compliance with Env-Or 607.01(b) and Env-Or 607.07.

(e) To initiate a permit modification procedure, the department shall provide the permittee with written notice that:

(1) Identifies the site by name, department identification number, location, and permit number;

(2) Explains each action the department proposes to take and the reasons for each proposed action;

(3) Identifies the department's authority for taking such an action;

(4) Explains the opportunity for an adjudicative hearing and related deadlines; and

(5) Lists the name, title, mailing address, and telephone number of the department representative who may be contacted regarding the notice.

(f) An adjudicative hearing on a permit modification initiated by the department pursuant to (e), above, shall:

(1) Be requested by the permittee to the department in writing within 30 days of receipt of the notice from the department; and

(2) Proceed in accordance with Env-C 200 as applicable to adjudicative proceedings.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 607.12 Permit Transfer.

(a) Subject to (f), below, prior to the transfer of a groundwater management permit to a new permittee, the current permittee shall file a written request for the transfer with the department on a form provided by the department.

(b) A transfer request shall include the following information:

(1) The department permit number;

(2) The site name, address, and tax map and lot number;

(3) The name, mailing address, daytime telephone number, and email address, if any, of the new permittee;

(4) The name, mailing address, daytime telephone number, and email address, if any, of the current permittee; and

(5) A summary of all monitoring results to date.

(c) Subject to (f), below, the current permittee and the person to whom the permit is proposed to be transferred shall sign the transfer request. Such signatures shall constitute certification that the information contained in the request is correct, complete, and not misleading to the knowledge and belief of the signer and that the signer agrees to comply with all requirements of the permit and all applicable rules.

(d) Within 45 days of receiving a request for transfer, the department shall approve or deny the transfer request and notify both parties of its decision in writing.

(e) The department shall deny an application to transfer a permit if:

(1) The permittee is not presently in compliance with the permit, this chapter, or any other applicable statute or rules, unless transferring the permit would facilitate returning the facility to compliance;

(2) The permittee fails to pay any outstanding penalties or fines issued under RSA 146-A, RSA 146-C, or RSA 147-A, unless all outstanding amounts will be paid in conjunction with the transfer;

(3) The permittee fails to pay any outstanding invoice associated with the department's recoverable cost pursuant to RSA 146-A, RSA 146-C, RSA 147-A, or RSA 147-B, unless all outstanding amounts will be paid in conjunction with the transfer; or

(4) The permittee has failed to perform in accordance with a court order, consent decree, or other settlement agreement relating to the property subject to the groundwater permit, unless transferring the permit would facilitate such performance.

(f) If the current permittee is unable or unwilling to file a written request for the transfer with the department, the new permittee may file the request. If the new permittee files the request pursuant to this paragraph, the signature of the current permittee shall not be required.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 608 ACTIVITY AND USE RESTRICTIONS

Env-Or 608.01 Implementation of an Activity and Use Restriction (AUR).

(a) An activity and use restriction (AUR) shall be implemented at sites where a department-approved remedial action relies on the restriction of site activities and uses to achieve or maintain protection of human health and the environment.

(b) An AUR shall:

(1) Establish prohibited and accepted site activities and uses to achieve or maintain protection of human health and the environment;

(2) Be incorporated either in full or by reference into all deeds, easements, mortgages, leases, licenses, occupancy agreements, or any other instruments conveying an interest in, or a right to use the property, or both;

(3) Run with the land so as to be the responsibility of the property owner upon recordation;

(4) Provide notice to holders of any interest in the site of the existence and location of contamination subject to the restriction; and

(5) Establish a duty to evaluate risks associated with proposed changes in site activities and uses prior to any such change in accepted activities and uses.

(c) The property owner shall notify the department in writing within 30 days of a discovery of a violation of any condition of a department-approved AUR recorded pursuant to Env-Or 608.05.

(d) Within 60 days of discovery of a violation pursuant to (c), above, a property owner shall submit recommendations to correct the violation to the department for approval, including a corrective action plan and a schedule for implementing the plan. The department shall approve the plan if it determines that the plan, if implemented, will correct the violation.

(e) The department shall send a self-certification form to the owner of a lot on which an AUR has been recorded pursuant to this part on a schedule approved in the remedial action for the site.

(f) Within 30 days of receipt of the self-certification form, the owner at the time of notice shall:

(1) Sign the form to certify that all conditions of the department-approved AUR are being met; and

(2) Return the signed form to the department.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 608.02 AUR Procedures.

(a) An applicant for an AUR shall obtain an application from the department and submit the completed application to the department within 90 days following department approval of a remedial action that relies on an AUR.

(b) Within 90 days from receipt of an AUR application, the department shall:

(1) Notify the applicant in writing of its decision to approve or deny the application; or

(2) If the application does not contain sufficient information to make a decision, request additional information from the applicant.

(c) The department shall approve an AUR application if the application contains all items required by Env-Or 608.03 and the proposed AUR is consistent with Env-Or 608.01(b).

(d) An AUR that is approved by the department shall become effective upon recordation.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 608.03 AUR Application.

(a) The applicant for an AUR shall provide the following to the department:

(1) All information required by the AUR application form obtained from the department;

(2) Where the AUR applies to an entire lot, at least one of the following:

a. A recordable plan of the site prepared by a New Hampshire registered land surveyor;

b. A reference by book and page number to a survey plan of the lot that has been recorded or registered in the registry of deeds for the county in which the site is located; or

c. A reference by book and page number to a property description of the lot that has been recorded or registered in the registry of deeds for the county in which the site is located;

(3) Where the area subject to the AUR comprises only a portion of a lot, the following:

a. A metes and bounds description of the restricted area; and

b. A recordable plan, prepared by a New Hampshire registered land surveyor, that shows the location of the restricted area in relation to the property boundaries of the site;

(4) The time period during which the AUR shall be effective;

(5) A precise description of the site activities and uses that will be prohibited on the site and allowed on the site;

(6) A description of how the restrictions will eliminate the risks to human health and the environment;

(7) A precise description of the measures which will be taken to ensure compliance of the activity and use restriction;

(8) A description of the procedures to be followed when an emergency requires immediate excavation of contaminated soil to repair utility lines or other infrastructure on the site, or to respond to other types of emergencies that might result in a significant risk to human health, evaluated pursuant to the procedure specified in Env-Or 606.19(d)(2) and (3), from exposure to contaminants at the site, which includes:

a. Notifying the department of such emergency condition;

b. Limiting disturbance of contaminated media to the minimum necessary to adequately respond to the emergency;

c. Undertaking specified precautions to reduce exposure of workers and neighbors of the site, to contaminated media; and

d. Preparation and implementation of a written plan for restoring the site to a condition consistent with the activity and use restrictions;

(9) An acknowledgment by the applicant that the AUR shall run with the land pursuant to Env-Or 608.01(b)(3);

(10) An analysis of the long-term feasibility of maintaining such AUR;

(11) An acknowledgement by the applicant to incorporate either in full or by reference the AUR into all deeds, easements, mortgages, leases, licenses, occupancy agreements, or any other instruments conveying an interest in and/or a right to use the property pursuant to Env-Or 608.01(b)(2);

(12) The procedures for modifying and terminating the AUR pursuant to Env-Or 608.06, and Env-Or 608.07;

(13) Title reference by which the property owner(s) acquired title to the property; and

(14) The proposed AUR document that will be recorded if the AUR application is approved.

(b) The applicant shall sign the application form. Such signature shall constitute certification that all information provided on or with the form or that otherwise is submitted by the applicant as part of the application is true, complete, and not misleading to the knowledge and belief of the signer.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 608.04 AUR Notification.

(a) Within 30 days of the date on which the department approves the AUR application pursuant to Env-Or 608.02(c), the applicant shall provide notice to current holders of any interest in the site of the existence and location of the contamination subject to the AUR.

(b) Notice sent pursuant to (a), above, shall be:

(1) On a form provided by the department; and

(2) Sent by certified mail, return receipt requested.

(c) Within 60 days of the date on which the department approves the AUR application pursuant to Env-Or 608.02(c), the applicant shall submit documentation of the notification required in (a), above, to the department.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 608.05 AUR Recordation.

(a) Within 60 days of the date on which the department approves the AUR application pursuant to Env-Or 608.02(c), the applicant shall:

(1) Sign and acknowledge the document; and

(2) Record the AUR document and a site plan prepared in accordance with Env-Or 608.03(a)(2) or (a)(3), as applicable, in the registry of deeds in the chain of title for each lot that is subject to the AUR.

(b) Within 30 days of recordation, the applicant shall submit a copy of the recorded AUR document and site plan to the department and the governing body of the municipality in which the site is located.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 608.06 AUR Modifications.

(a) The property owner shall submit any proposed modification of an AUR and obtain department approval of the modification pursuant to Env-Or 608.03 before implementing any change in activity on or use of the property that is subject to the AUR.

(b) If proposed changes in site activities or uses necessitate additional remedial actions to protect human health or the environment, the property owner shall complete such remedial actions before the new or altered activities commence.

(c) Within 60 days of receipt of the department's approval, the property owner shall record the modified AUR in the registry of deeds in the chain of title for the lot that is subject to the AUR. The modification shall not take effect until so recorded.

(d) Within 30 days of recordation, the property owner shall submit a copy of the recorded modified AUR to the department and the governing body of the municipality in which the site is located.

(e) Within 30 days of the date on which the department approves an AUR modification, the property owner shall provide notice to current holders of any interest in the site on a form provided by the department sent by certified mail, return receipt requested, of the existence and location of the contamination that is subject to the AUR.

(f) Within 60 days of the date on which the department approves an AUR modification, the property owner shall submit documentation of the notification required in (e), above, to the department.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 608.07 AUR Termination and Release of Recordation.

(a) In cases where an AUR is no longer necessary to achieve or maintain protection of human health and the environment, the property owner shall submit a request to terminate the AUR to the department in writing with supporting information that demonstrates the AUR is no longer necessary to achieve or maintain protection of human health and the environment.

(b) The department shall issue a release of recordation for the AUR to the property owner upon determining that the AUR is no longer necessary to achieve or maintain protection of human health and the environment.

(c) Within 60 days of receipt of a release of recordation from department, the property owner shall record the release of recordation notice of the AUR in the registry of deeds in the chain of title for the lot designated.

(d) Within 30 days of recordation, the property owner shall submit a copy of the recorded release of recordation notice to the department and the governing body of the municipality in which the site is located.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 609 CERTIFICATES OF COMPLETION OR NO FURTHER ACTION

Env-Or 609.01 Certificate of Completion.

(a) Upon completion of the remedial action, the responsible party may request the department to issue a certificate of completion.

(b) The department shall issue the requested certificate of completion if:

(1) All activities specified in the approved remedial action, with the exception of groundwater monitoring, have been completed;

(2) The performance standards specified for the approved remedial action and the groundwater management permit have been achieved;

(3) All monitoring requirements under the groundwater management permit are being met;

(4) Any necessary activity and use restrictions have been implemented;

(5) All penalty(ies) or fine(s) issued under RSA 146-A, RSA 146-C, RSA 147-A, and RSA 485-C have been paid;

(6) All invoices associated with the department's recoverable costs pursuant to RSA 146-A, RSA 146-C, RSA 147-A, RSA 147-B, and RSA 485-C have been paid; and

(7) All fees and costs due under RSA 147-F have been paid.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 609.02 Certificate of No Further Action. The department shall issue a certificate of no further action, which certifies that no additional investigation, remedial measures, or groundwater monitoring will be required by the department, if:

(a) All human health hazards associated with direct exposure to contaminants through dermal contact, ingestion, and inhalation have been eliminated;

(b) All necessary activity and use restrictions have been implemented;

(c) All sources of groundwater contamination have been eliminated;

(d) All on-site and off-site dissolved contamination levels meet groundwater quality criteria as specified in Env-Or 603.01;

(e) All recorded release of recordation notices are on file with the department as required by Env-Or 607.09;

(f) All penalty(ies) or fine(s) issued under RSA 146-A, RSA 146-C, RSA 147-A, and RSA 485-C have been paid;

(g) All invoices associated with the department's recoverable cost pursuant to RSA 146-A, RSA 146-C, RSA 147-A, RSA 147-B, and RSA 485-C have been paid; and

(h) All fees and costs due under RSA 147-F have been paid.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 610 MONITORING AND REPORTING

Env-Or 610.01 Applicability. All sampling, analyses, and reporting required under Env-Or 600 shall be in accordance with this part unless otherwise specified.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 610.02 Sampling and Analysis.

(a) At all sites that are subject to Env-Or 600, the responsible party shall:

(1) Monitor groundwater quality at all sites to ensure that groundwater quality complies with the terms of the permit, if any, and the groundwater quality criteria specified in Env-Or 603.01;

(2) Monitor surface water points and water supply wells to ensure that water quality complies with applicable water quality standards and the terms of the permit, if any;

(3) Monitor sampling points in the active remediation system to ascertain that design treatment efficiencies are achieved;

(4) Install at least one hydraulically upgradient groundwater monitoring well to monitor ambient groundwater quality; and

(5) Operate and maintain the monitoring wells, piezometers, and other measurement, sampling, and analytical devices so that they perform to design specifications throughout the life of the monitoring program.

(b) The parameters to be monitored shall be determined on a site-specific basis depending on the regulated contaminants present in the discharge or contaminated area.

(c) The frequency and location of water quality monitoring shall be determined on a site-specific basis depending on the hydrogeologic and contaminant characteristics of the site, predicted rates of groundwater flow, and treatment methods employed.

(d) Analyses shall be performed by a laboratory certified by the U.S. Environmental Protection Agency (US EPA) or the department pursuant to Env-C 300.

(e) Sampling shall be performed in accordance with the following references, available as noted in Appendix B, as applicable:

(1) "Practical Guide for Ground-Water Sampling," document identification number EPA/600/2-85/104, US EPA, dated September 1985;

(2) "RCRA Ground-Water Monitoring: Draft Technical Guidance," document identification number PB87107751, US EPA, dated November 1992;

(3) "Standards Related to Environmental Sampling", 5th Edition, document identification number ASTM SAMP14, dated 2014 (ASTM SAMP14);

(4) "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition" document identification number EPA/625/R-96/010b, US EPA, dated January 1999;

(5) "SW 846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", US EPA, dated February 2007; and

(6) "Standard Guide for Sampling Waste and Soils for Volatile Organic Compounds" document identification number ASTM D 4547-2009, dated 2009.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 610.03 Reporting.

(a) The responsible party shall submit the results of all required sampling and analysis, including quality assurance and quality control results, to the department no later than 45 days after the sampling date, except as provided for in (b) and (c), below.

(b) Within 5 business days after receiving results, the responsible party shall submit all water supply well results that show a violation of the AGQS in writing to the department and the owner of the property on which the water supply well is located.

(c) Within 5 business days after receiving results, the responsible party shall submit all indoor air quality results that indicate a significant risk to human health in writing to the department and the owner of the property.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 610.04 Groundwater Monitoring Wells.

(a) Each monitoring well shall be designed, installed, developed, maintained, and decommissioned in accordance with We 100-1000 and the practices described in:

(1) "Standards on Environmental Site Characterization" Fourth Edition, document identification number ASTM SITECD10, dated 2010, available as noted in Appendix B; and

(2) ASTM ENVSAMP14, available as noted in Appendix B.

(b) Each monitoring well shall be:

(1) Constructed, maintained, and decommissioned only by a New Hampshire-licensed water well contractor holding a valid technical drillers license under RSA 482-B;

(2) Developed prior to sampling; and

(3) Allowed to equilibrate a minimum of 2 weeks following installation prior to sampling.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 611 CONTAMINATED SOIL

Env-Or 611.01 Requirements for Managing Contaminated Soils.

(a) The responsible party shall manage contaminated soils in a manner that protects human health and the environment.

(b) The responsible party shall manage contaminated soils in accordance with applicable local, state and federal requirements including but not limited to:

(1) RSA 147-A and rules adopted pursuant thereto, relative to management of hazardous waste;

(2) RSA 149-M and rules adopted pursuant thereto, relative to management of solid waste;

(3) RSA 485, RSA 485-A, and RSA 485-C and rules adopted pursuant thereto, relative to protection of groundwater; and

(4) RSA 482-A and rules adopted pursuant thereto, relative to the protection of wetlands.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 611.02 Definitions.

(a) "Non-hazardous oil-contaminated soil (NOCS)" means soil that:

(1) Is contaminated with oil;

(2) Is not a hazardous waste as defined in RSA 147-B:2, VII; and

(3) Is certified in accordance with Env-Or 611.03.

(b) "Non-hazardous contaminated soil (NCS)" means soil that:

(1) Contains a regulated contaminant;

(2) Is not a hazardous waste as defined in RSA 147-B:2, VII; and

(3) Cannot be certified as NOCS pursuant to Env-Or 611.03.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 611.03 Non-hazardous Oil-Contaminated Soil (NOCS) Certification.

(a) Contaminated soils associated with a discharge of oil shall be evaluated as described in this section to determine if the soils can be certified as NOCS.

(b) The responsible party shall complete a summary of site ownership history and history of use at the site.

(c) The responsible party shall retain an environmental consultant or environmental contractor to observe the site and the soil and review the summary of site ownership history and history of use provided by the responsible party pursuant to (b), above.

(d) The soil shall be certified as NOCS by the responsible party's environmental consultant or environmental contractor if:

(1) The contaminated soils are derived from an oil discharge from a household or from underground storage facilities regulated under RSA 146-C; and

(2) A history of site ownership and operation based on documented land use in accordance with ASTM E 1527 reveals no known activity that might have caused the soil to become contaminated with a hazardous waste as defined in RSA 147-B:2, VII.

(e) If contaminated soils are not generated from households or from underground storage facilities regulated under RSA 146-C, or a history of site ownership and operation based on documented land use in accordance with ASTM E 1527 reveals some activity that might have caused the soil to become contaminated with a hazardous waste as defined in RSA 147-B:2, VII, the responsible party shall conduct a hazardous waste determination in accordance with Env-Hw 100 et seq.

(f) The contaminated soil sampled pursuant to (e), above, shall be certified as NOCS by the responsible party's environmental consultant or environmental contractor only if the testing indicates the soil is not a hazardous waste as defined in RSA 147-B:2, VII.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 611.04 Contaminated Soil Sampling. NOCS or NCS destined for off-site treatment or disposal shall be sampled and analyzed in accordance with the following prior to transportation off-site:

(a) Subject to (c), below, for stockpiled contaminated soils destined for off-site treatment or disposal, the responsible party shall collect representative samples in accordance with the following:

(1) At least one composite sample shall be collected for every 200 tons destined for off-site treatment or disposal up to 2,000 tons, plus at least one composite sample for every 500 tons above the initial 2,000 tons;

(2) Each composite sample shall consist of at least 8 discrete samples collected from the stockpile; and

(3) Each discrete sample shall be taken from newly exposed soil a minimum of 12 inches deep within the stockpile and combined with the other required discrete samples to complete each composite sample;

(b) Subject to (c), below, for in-situ contaminated soils destined for off-site treatment or disposal, the responsible party shall collect representative samples in accordance with the following:

(1) At least one boring/test pit shall be completed for every 200 tons destined for off-site treatment or disposal up to 2,000 tons, plus at least one boring/test pit for every 500 tons above the initial 2,000 tons;

(2) The borings/test pits required by (1), above, shall be completed on an evenly-spaced grid pattern throughout the contaminated soil area;

(3) At least one boring/test pit shall be located in the most contaminated soil area;

(4) At least one soil sample shall be collected from the contaminated zone of each boring/test pit required by (1) through (3), above;

(c) If the quantity of NOCS is less than 50 tons, sampling and analysis shall not be required except as required by the receiving facility; and

(d) Representative soil samples collected in accordance with (a) or (b), above, shall be analyzed for the chemicals of potential concern as identified through a history of site ownership and operation based on documented land use in accordance with ASTM E 1527 and previous sampling, and in accordance with the receiving facility's requirements.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 611.05 Contaminated Soil Storage.

(a) NOCS or NCS exceeding the soil remediation standards in Table 600-2 awaiting off-site disposal may be temporarily stored at the site of origin for a period not to exceed 4 months.

(b) NOCS or NCS shall be stored in a manner that prevents the soil from coming in contact with the ground, precipitation, and storm water run-off, for example on and covered with an impermeable material that is chemically compatible with the contamination.

(c) The contaminated soil pile shall only be uncovered when contaminated soil is being added to or removed from the pile.

(d) Public access to the contaminated soil pile storage area shall be restricted.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 611.06 Contaminated Soil Disposal and Reuse.

(a) Except as provided for by (b) and (c) below, all NOCS or NCS that exceed the soil remediation standards in Table 600-2 shall be either:

(1) Managed on-site in accordance with a remedial action approved by the department pursuant to Env-Or 606.03; or

(2) Removed from the site to an authorized treatment or disposal facility holding all requisite federal, state, or local permits, licenses, or approvals.

(b) NOCS or NCS that exceeds the soil remediation standards listed in Table 600-2 but meets site-specific standards developed in accordance with Env-Or 606.19 may be managed on the site.

(c) NOCS or NCS that exceeds the soil remediation standards listed in Table 600-2 but is managed in accordance with a department-approved AUR implemented in accordance with Env-Or 608 may be managed on the site.

(d) NOCS or NCS that meets the soil remediation standards listed in Table 600-2 may be left in place or reused on site, or removed from the site to an authorized treatment or disposal facility holding all requisite federal, state, or local permits, licenses, or approvals.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 611.07 Hazardous Waste Contaminated Soil Storage, Treatment, and Disposal. Soils characterized as a hazardous waste shall be stored, treated, and disposed of in accordance with RSA 147-A and Env-Hw 100 et seq.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

PART Env-Or 612 WAIVERS

Env-Or 612.01 Purpose. The purpose of the rules in this part is to establish procedures and criteria for requesting a waiver from one or more requirements established in Env-Or 600.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15

Env-Or 612.02 Definition. For purposes of this part, the following definition shall apply:

(a) "Site remediation program" means the program implemented by the department to ensure and oversee the investigation, management, and remediation of sites contaminated by regulated contaminants in order to facilitate the efficient remediation of such sites.

Source. #10831, eff 6-1-15

Env-Or 612.03 Initiating a Waiver Request.

(a) Any owner or responsible party (RP) who wishes to request a waiver of one or more specific requirements established in this chapter shall submit the information specified in Env-Or 612.03 in writing to the department.

(b) If the person who is requesting the waiver is not the owner of the property, the requestor shall:

(1) Seek the concurrence of the site owner in advance of submitting the request to the department; and

(2) State in the request submitted to the department whether the site owner concurs with the request.

(c) If there is more than one RP and all of the RPs are not joining in the waiver request, the requestor shall:

(1) Seek the concurrence of each non-participating RP in advance of submitting the request to the department; and

(2) For each non-participating RP, state in the request submitted to the department whether the RP concurs with the request.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 612.02)

Env-Or 612.04 Information Required for Waiver Request. A request for a waiver shall include the following information:

(a) A description of the site to which the waiver request relates, including name, address, and department site number;

(b) The name, mailing address, daytime telephone number, and email address, if any, of the requestor and whether the requestor is the site owner or an RP;

(c) The name, mailing address, daytime telephone number and email address, if any, of the site owner, if other than the requestor, and of each other RP, if any;

(d) Identification of the rule for which a waiver is being sought;

(e) A full explanation of why a waiver is being requested, including an explanation of the economic and operational consequences of complying with the rule as written;

(f) A full explanation of the alternative(s) proposed to be implemented in lieu of complying with the rule(s) for which a waiver is sought, if any, with backup data for support;

(g) A statement of whether the requested waiver can be of limited duration; and

(h) A full explanation of how granting the requested waiver would meet the criteria specified in Env-Or 612.07(b).

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 612.03)

Env-Or 612.05 Signatures Required for Waiver Request.

(a) The person(s) requesting the waiver shall authorize an individual to sign and date the request.

(b) The authorized individual shall sign and date the request and print or type his or her name and title by the signature.

(c) The signature shall constitute certification that:

(1) The information provided is true, complete, and not misleading to the knowledge and belief of the signer; and

(2) The signer understands that:

a. The submission of false, incomplete, or misleading information is grounds for denying the waiver request or revoking any waiver that is granted based on the information; and

b. He or she is subject to the penalties specified in New Hampshire law, currently RSA 641:3, for making unsworn false statements.

Source. #10831, eff 6-1-15

Env-Or 612.06 Submittals by Non-Concurring Persons.

(a) If the site owner is not the requestor and does not concur with the request, the site owner may submit information in writing to the department as to why the requested waiver should not be granted.

(b) If there is more than one RP and one or more RPs do not concur with the request, the non-concurring RPs may submit information in writing to the department as to why the requested waiver should not be granted.

(c) Any information submitted pursuant to (a) or (b), above, shall be filed within 20 days of the date the waiver request was filed, provided that if the 20th day falls on a Saturday, Sunday, or state legal holiday the deadline shall be the first business day thereafter.

Source. #10831, eff 6-1-15

Env-Or 612.07 Department Action on Waiver Request.

(a) The department shall review each waiver request and any information submitted pursuant to Env-Or 612.06 that relates to the request.

(b) The department shall grant a waiver if it determines that:

(1) The requirement to be waived is not established by statute, unless the statute that establishes the requirement expressly authorizes the department to grant waivers of the requirement;

(2) Granting a waiver will not result in any adverse effect on human health or the environment; and

(3) Granting a waiver is consistent with the purpose of the site remediation program.

(c) The department shall include such conditions, including time limitations, as are necessary to ensure that the activities conducted pursuant to the waiver will meet the criteria specified in (b), above.

(d) The department shall issue a written response to a request for a waiver within 60 days of receipt of the request. If the request is denied, the written response shall specify the reason(s) for the denial. If information was submitted by a non-concurring owner or RP pursuant to Env-Or 612.05 and a waiver is granted, the written response shall explain why the objections did not warrant denying a waiver.

Source. (See Revision Note at p. iii) #8812, eff 2-1-07; ss by #10831, eff 6-1-15 (from Env-Or 612.03)

PART Env-Or 613 FEES FOR EXPEDITED REVIEW OF ENVIRONMENTAL SITE ASSESSMENT REPORTS

Env-Or 613.01 Determination of Property Valuation and Fees.

(a) The department shall determine the equalized assessed valuation of the property for which an expedited review of the environmental site assessment report is sought by dividing the assessed value of the property as determined by the municipality by the municipality's most recent equalization ratio.

(b) As specified in RSA 485:3-b, I, the fee shall be determined based on the equalized assessed valuation as shown in Table 600-3:

Table 600-3: Expedited Review Fee Based on Equalized Assessed Valuation

Equalized Assessed Valuation	Fee
$0 to $250,000	$1,800
$250,001 to $500,000	$2,250
$500,001 to $1,000,000	$3,750
greater than $1,000,000	$7,500

Source. #9213, eff 7-23-08; ss by #10831, eff 6-1-15

APPENDIX A: STATE STATUTES IMPLEMENTED

Rule Section(s)	State Statute Implemented
Env-Or 600 (see below for additional statutes)	RSA 146-A:3-a; RSA 146-C:11; RSA 147-A:9; RSA 147-F:11-13 & 15; RSA 485-C:1, 6, 6-a, & 6-b
Env-Or 601	RSA 146-A:11-c; RSA 146-C:9; RSA 147-A:3; RSA 147-F:18; RSA 485-C:4
Env-Or 602	RSA 146-A:11-c; RSA 146-C:9; RSA 147-A:3; RSA 147-F:18; RSA 485-C:4
Env-Or 603	RSA 485-C:4, III
Env-Or 604.01 - 604.03	RSA 485-C:4, IX; RSA 485-C:14-b
Env-Or 604.04	RSA 147-A:11
Env-Or 604.05 - 604.08	RSA 146-A:5; RSA 146-C:11, I-a
Env-Or 605.01	RSA 146-A:11-C, V-a, RSA 146-C:9-X; RSA 146-C:9-XI; RSA 147-A:3-VII; RSA 485-C:4. VIII
Env-Or 605.02	RSA 147-A:3
Env-Or 605.03	RSA 146-A:11-C, V-a; RSA 146-C:9-X; RSA 146-C:9-XI
Env-Or 605.04 - 605.09	RSA 146-A:11-C, V-a; RSA 146-C:9-X; RSA 146-C:9-XI, RSA 147-A:3-VII; RSA 485-C:4. VIII
Env-Or 605.10	RSA 146-A:11-C, V-a, RSA 146-C:9-X; RSA 146-C:9-XI
Env-Or 606 (see also specific sections listed below)	RSA 146-A:11-C, V-a, RSA 146-C:9-X, RSA 147-A:3-IV RSA 485-C:4; VIII; RSA 147-F:11
Env-Or 606.10 - 606.21	RSA 147-F:12, RSA 147-F:13
Env-Or 606.15(a) and (b) intro.	RSA 146-A:11-C, V-a; RSA 146-C:9, X; RSA 147-A:3, IV; RSA 485-C:4, VIII; RSA 147-F:11; RSA 147-F:12; RSA 147-F:13
Env-Or 606.19(b)	RSA 146-A:11-C, V-a; RSA 146-C:9, X; RSA 147-A:3, IV; RSA 485-C:4, VIII; RSA 147-F:11; RSA 147-F:12; RSA 147-F:13
Env-Or 607.01 - 607.04	RSA 485-C:4, VIII; RSA 485-C:4, X; RSA 485-C:4, XI
Env-Or 607.02(b)	RSA 485-C:4, VIII; RSA 485-C:4, X; RSA 485-C:4, XI
Env-Or 607.03	RSA 485-C:4, VIII; RSA 485-C:4, X; RSA 485-C:4, XI
Env-Or 607.05	RSA 485-C:4, VIII; RSA 485-C:6-a
Env-Or 607.06 & 607.07	RSA 485-C:4, VIII; RSA 485-C:4, X; RSA 485-C:4, XI
Env-Or 607.08	RSA 485-C:4, IX
Env-Or 607.09	RSA 485-C:6-b
Env-Or 607.10 - 607.12	RSA 485-C:4, VIII
Env-Or 608	RSA 146-A:11-C, V-a; RSA 146-C:9-X; RSA 147-A:3-IV; RSA 147-F:15
Env-Or 609	RSA 146-A:11-C, V-a; RSA 146-C:9-X; RSA 147-A:3-IV; RSA 485-C:4. VIII; RSA 147-F:11; RSA 147-F:13
Env-Or 610	RSA 146-A:11-C, V-a; RSA 146-C:9-X; RSA 147-A:3-IV; RSA 485-C:4, VIII; RSA 147-F:11; RSA 147-F:13
Env-Or 611	RSA 146-A:11-C,V-a; RSA 146-C:9-X; RSA 147-A:3-IV; RSA 147-F:11
Env-Or 612	RSA 541-A:22, IV
Env-Or 613	RSA 485:3-b, I

APPENDIX B: INCORPORATED REFERENCES

Rule (Env-Or)	Reference	Obtain At:
		ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA 19428-2959 1-877-909-2786 (USA & Canada) http://www.astm.org/
606.04(d) 611.03(d)(2) 611.03(e) 611.04(d)	Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process (ASTM E 1527-13), 2013	PDF $69
606.13(e) 606.19(c) 606.19(d)(2)&(3)	Standard Guide for Risk Based Corrective Action (ASTM E 2081-00(2010)e1)	PDF $80;Hardcopy $80 + S/H
606.19(c) 606.19(d)(2)&(3)	Standard Guide for Risk Based Corrective Action at Petroleum Release Sites (ASTM E 1739-95(2010)e1)	PDF $69
610.02(e)(3) 610.04(a)(2)	Standards Related to Environmental Sampling", 5th Edition, (ASTM SAMP14) 2014	Online $199
610.02(e)(6)	Standard Guide for Sampling Waste and Soils for Volatile Organic Compounds (ASTM D4547-09) -- 2009	PDF $49
610.04(a)(1)	Standards on Environmental Site Characterization, Fourth Edition (SITECD-10) -- 2010	Online $289
		Environmental Protection Agency 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 (202) 272-0167
610.02(e)(1)	Practical Guide for Ground-Water Sampling, document identification number EPA/600/2-85/104, September 1985	No cost to download from: http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=30000FRY.txt
610.02(e)(2)	RCRA Ground-Water Monitoring: Draft Technical Guidance, document identification number PB87107751, November 1992	No cost to download from: http://www.epa.gov/epawaste/hazard/correctiveaction/resources/guidance/sitechar/gwmonitr/rcra_gw.pdf
610.02(e)(4)	Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition, document identification number EPA/625/R-96/010b	No cost to download from: http://www.epa.gov/ttnamti1/files/ambient/airtox/tocomp99.pdf
610.02(e)(5)	SW 846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, February 2007	No cost to download from: http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm

APPENDIX C: STATUTORY DEFINITIONS

RSA 310-A:2:

V. "Engineer of record" means a professional engineer who seals drawings, reports, or documents for a project. The seal shall acknowledge that the professional engineer prepared, coordinated, or had subordinates prepare under the direct supervision of the professional engineer, drawings, reports, or documents for a project. The engineer of record shall not be responsible for engineering work performed and sealed by other professional engineers, including independent consulting engineers who work under the coordination of the engineer of record.

RSA 485-C:2:

I. "Ambient groundwater quality standards" means maximum concentration levels for regulated contaminants in groundwater which result from human operations or activities, as delineated in RSA 485-C:6.

VIII. "Groundwater" means subsurface water that occurs beneath the water table in soils and geologic formations.

XIII. "Regulated contaminant" means any physical, chemical, biological, radiological substance or other matter, other than naturally occurring substances at naturally occurring levels, in water which adversely affects human health or the environment.

RSA 146-A:2:

VI-b. "Surface water" means perennial and seasonal streams, lakes, ponds, and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, watercourses, and other bodies of water, natural or artificial;

Exhibit 1

Options to Increase Storage in Pennichuck Brook

Exhibit 1:
Options to Increase Storage in Pennichuck Brook

COMPREHENSIVE ENVIRONMENTAL INC.

APRIL 16, 2019

Summary of Options To Increase Storage

<u>Goal to increase backup storage in emergency situation</u>

- Merrimack River lost as a supply for several months
- Worst Case Drought Condition
- Active Storage Improvement Methods:
  - Dredging
  - Water Level / Outlet Adjustments
  - Raw Water Wells

Summary of Current Storage & Supply

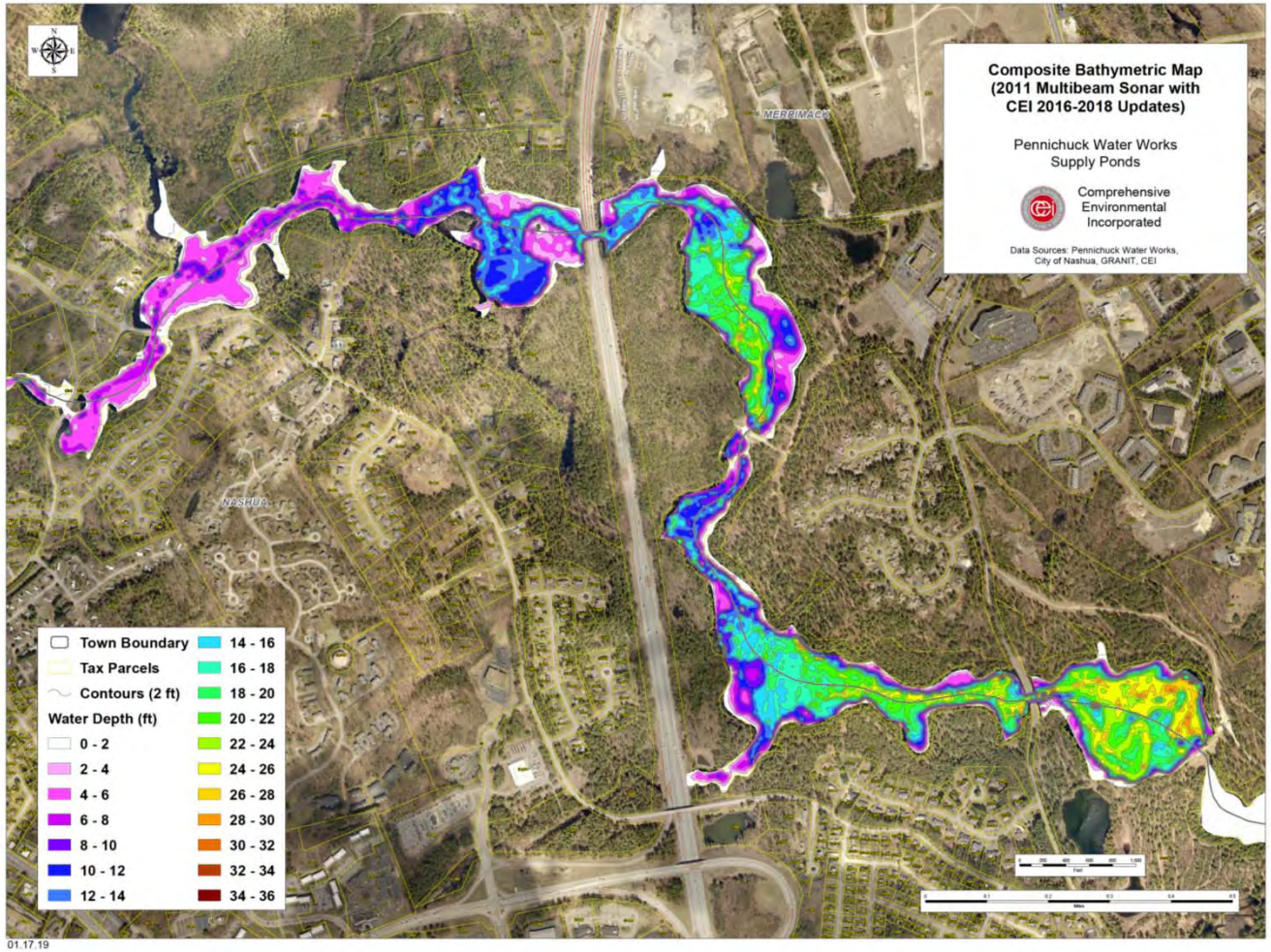
- Required Daily Supply – 10 MGD
- Estimated daily base flow from watershed – 25 MGD
- Estimated average stream low flow (7Q10) = 0.4 MGD
- On an average annual basis stormwater runoff – 6.7 MGD

- Harris Upper Active Storage – 188.2 MG = 19 days
- Harris Lower Active Storage – 159.3 MG = 16 days
- Bowers Active Storage – 148.1 MG = 15 days
- **Total Active Storage – 495.6 MG = 50 days**

- Harris Upper Dead Storage – 5.4 MG = 0.5 days
- Harris Lower Dead Storage – 1.1 MG = 0.1 days
- Bowers Dead Storage – 58.6 MG = 6 days

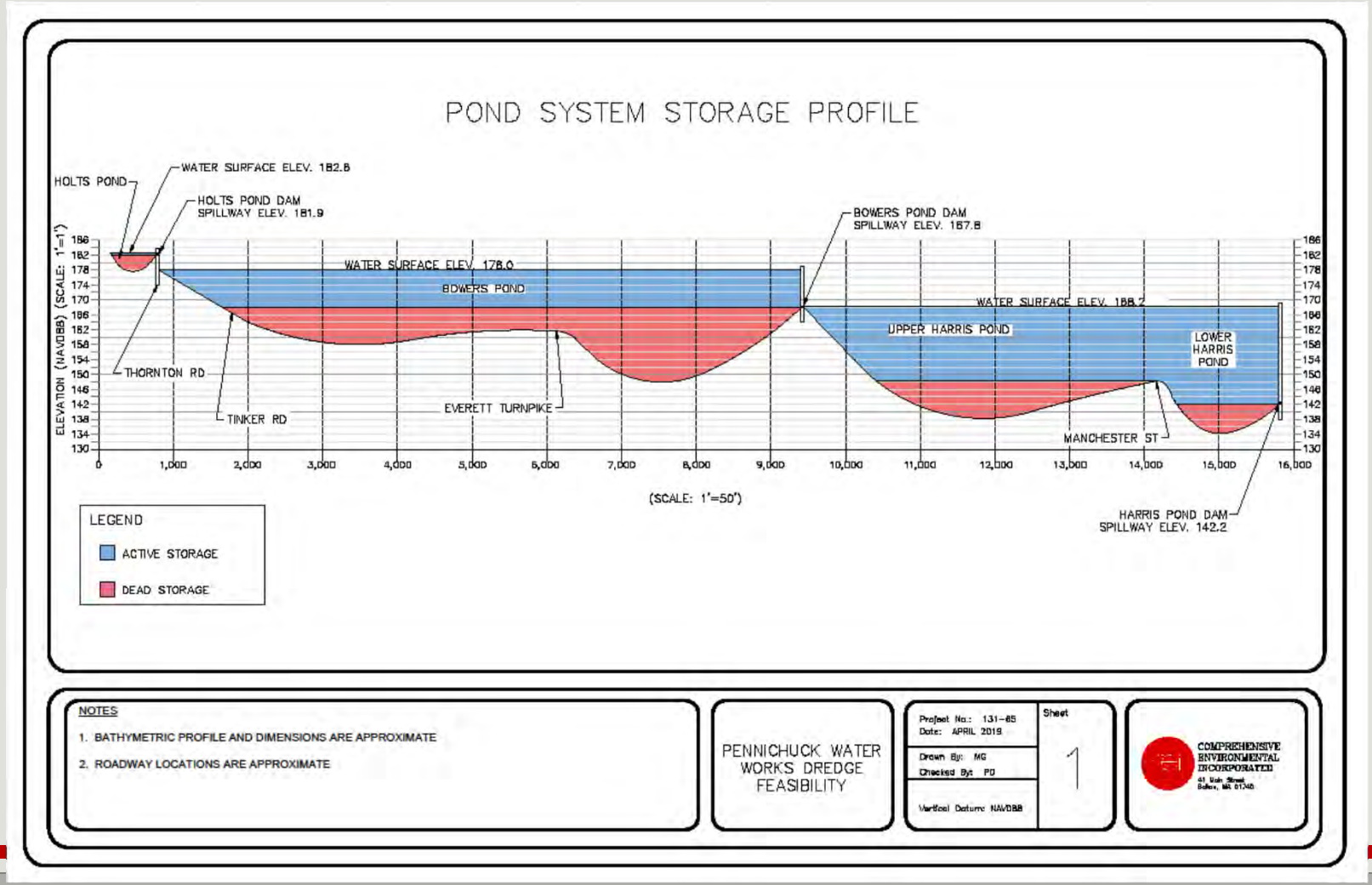
Summary of Current Storage & Supply

Existing Conditions - Pond System Bathymetry



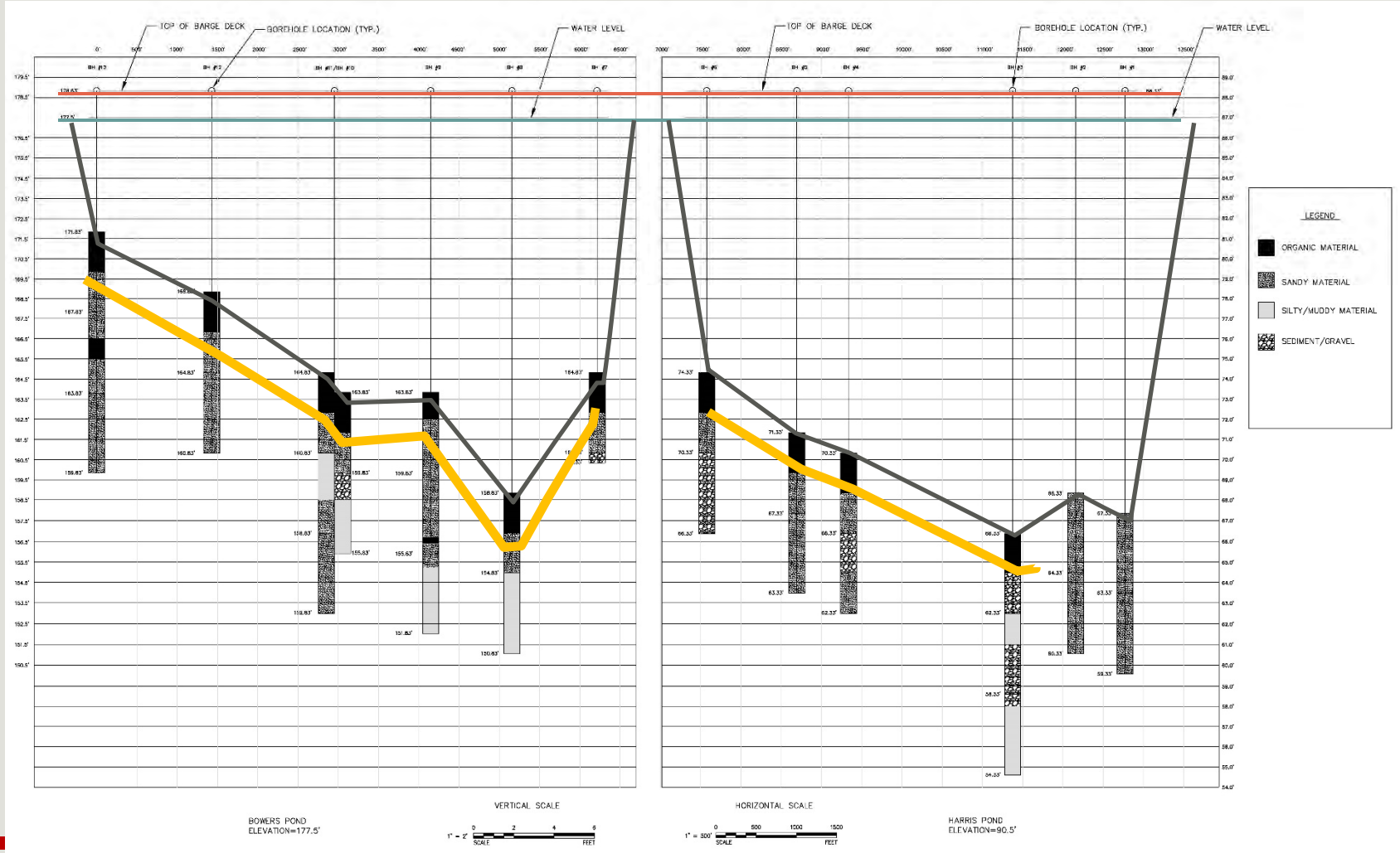
Summary of Current Storage & Supply

Existing Conditions - Pond System Storage Profile



Summary of Current Storage & Supply

Existing Conditions - Sediment Profiles



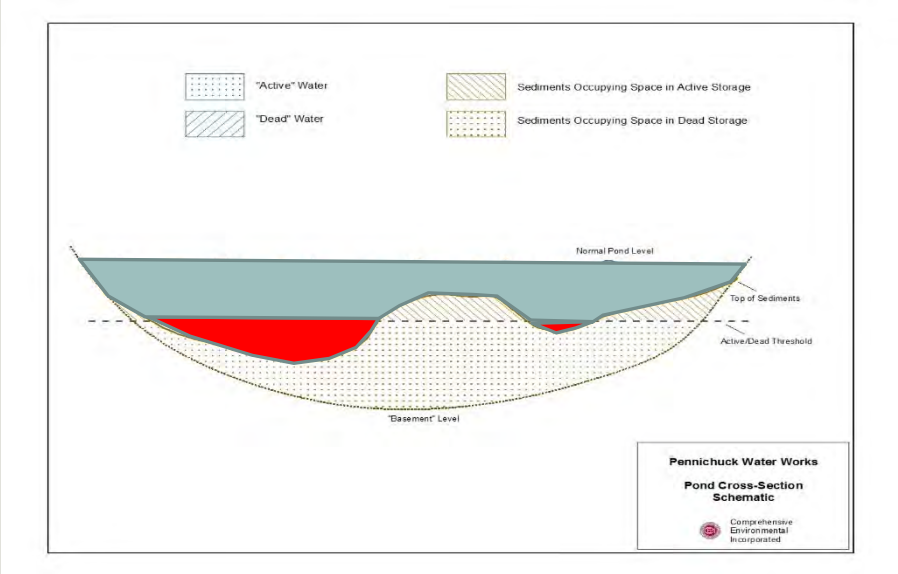
Summary of Current Storage & Supply

- Timeline for complete loss of storage

(based on previous study result - 0.33 in/year)

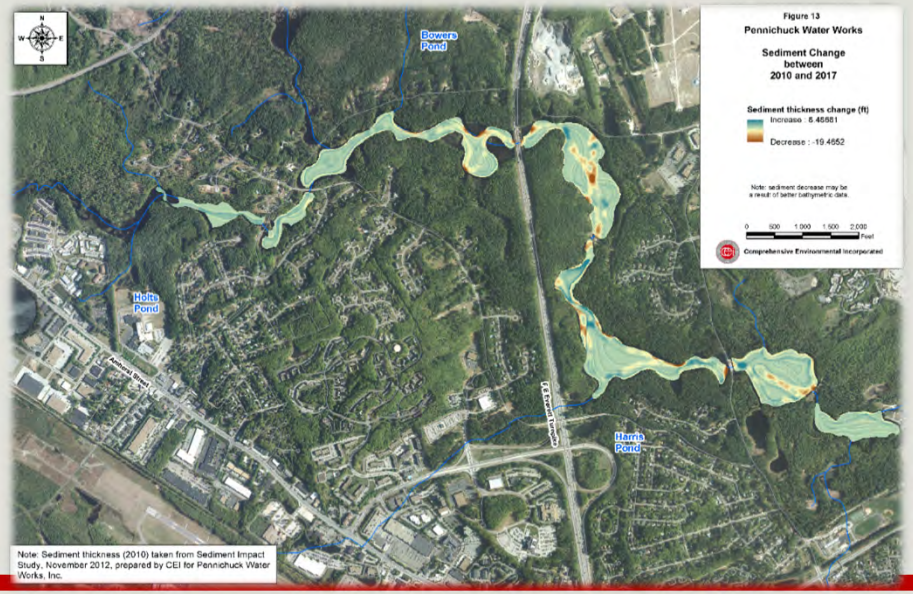
- Upper Harris Dead Storage - 80 years
- Lower Harris Dead Storage - 50 years

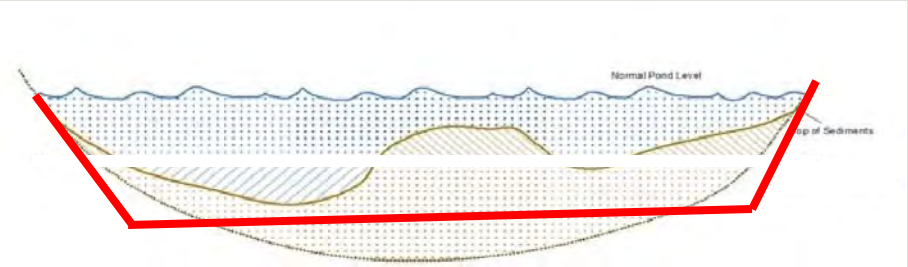
- Upper Harris Active Storage - 450 years
- Lower Harris Active Storage - 670 years



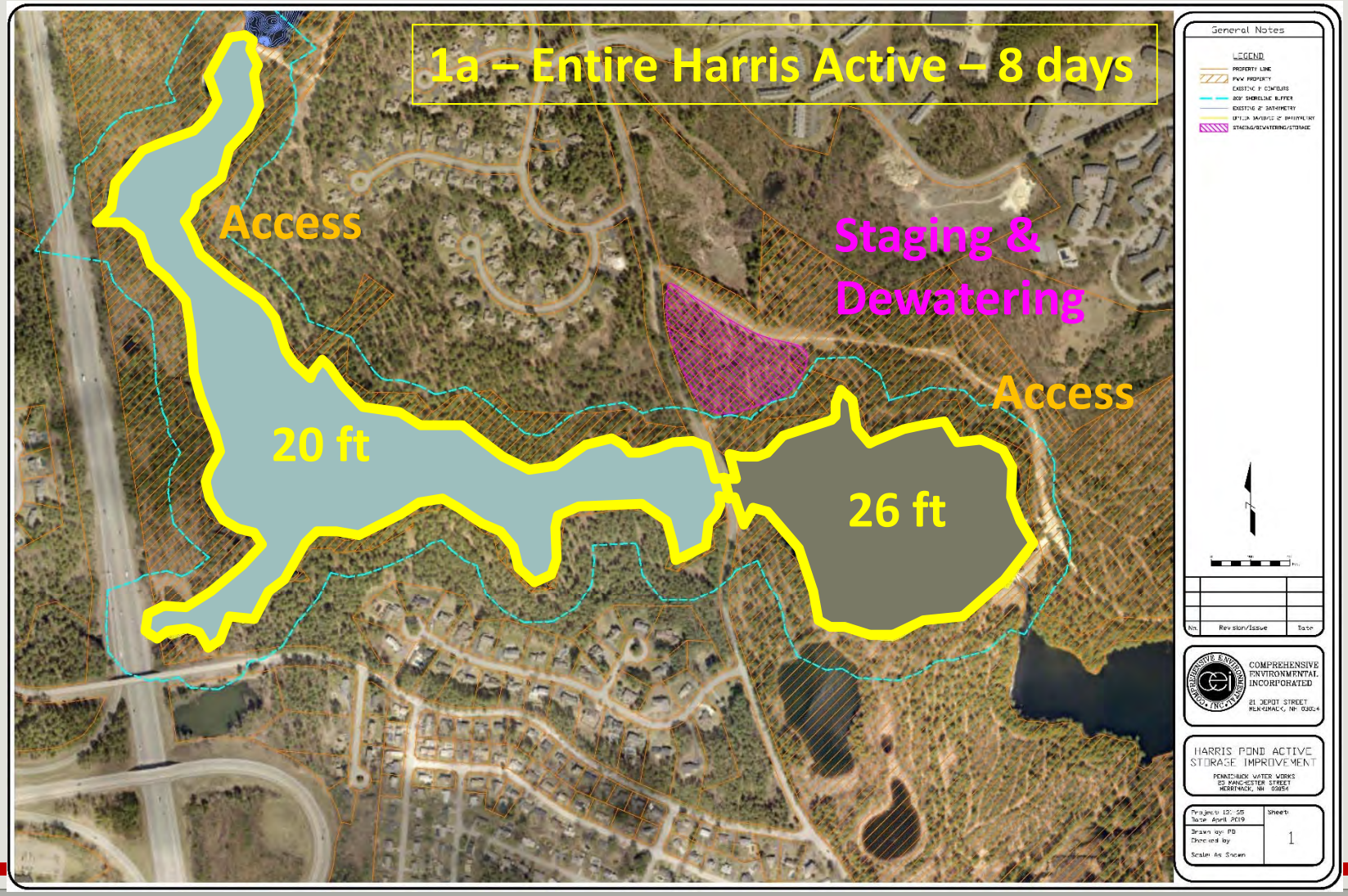
Dredge Options

- Option 1a – Dredge Entire Harris Active (20-26 ft) – 8 days
- Option 1b – Dredge Upper Harris Active (20 ft) – 5 days
- Option 1c – Dredge Lower Harris Active (26 ft) – 3 days
- Option 1d – Dredge Harris “organics” (3-4 ft) – 3 days

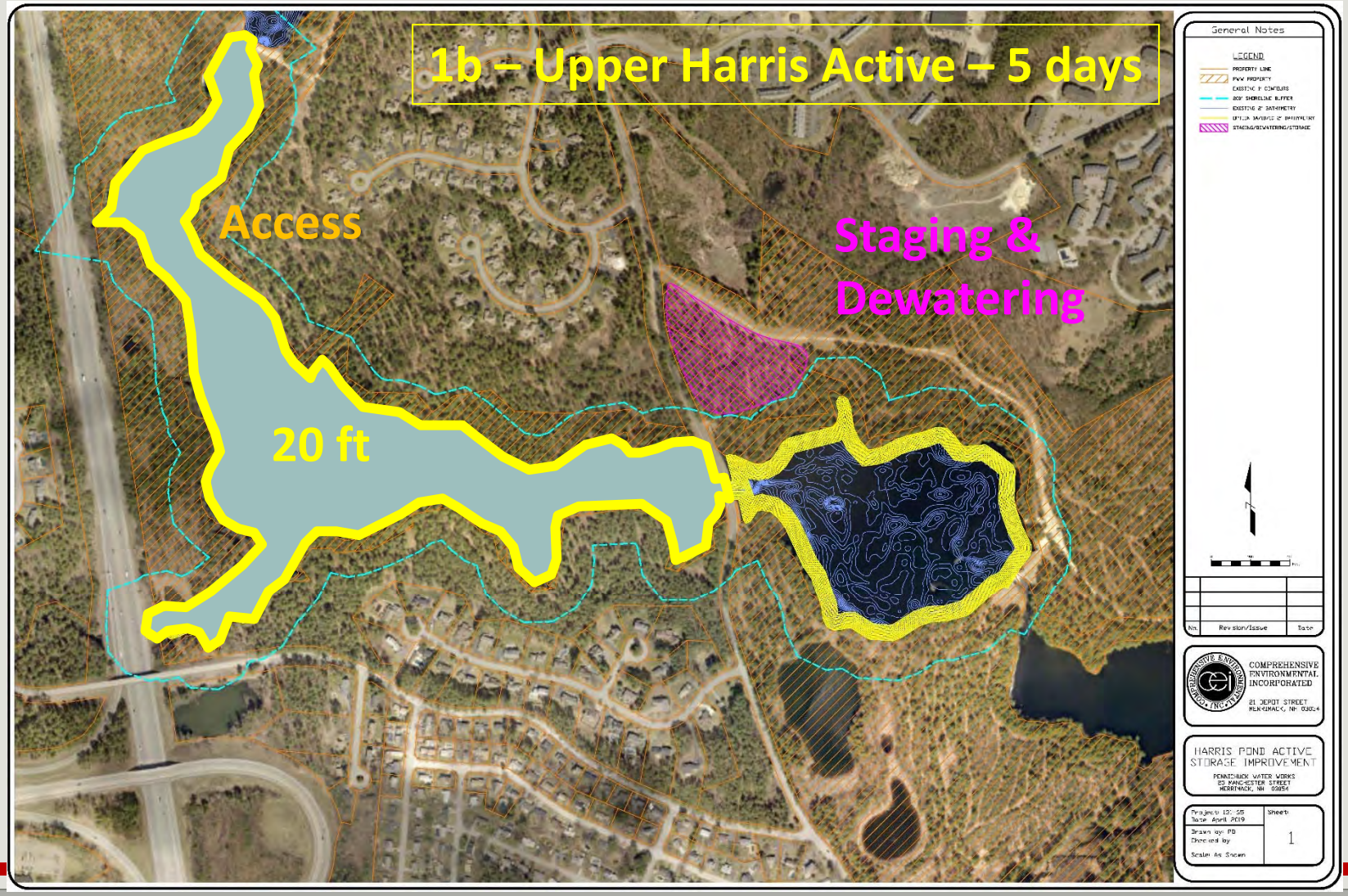




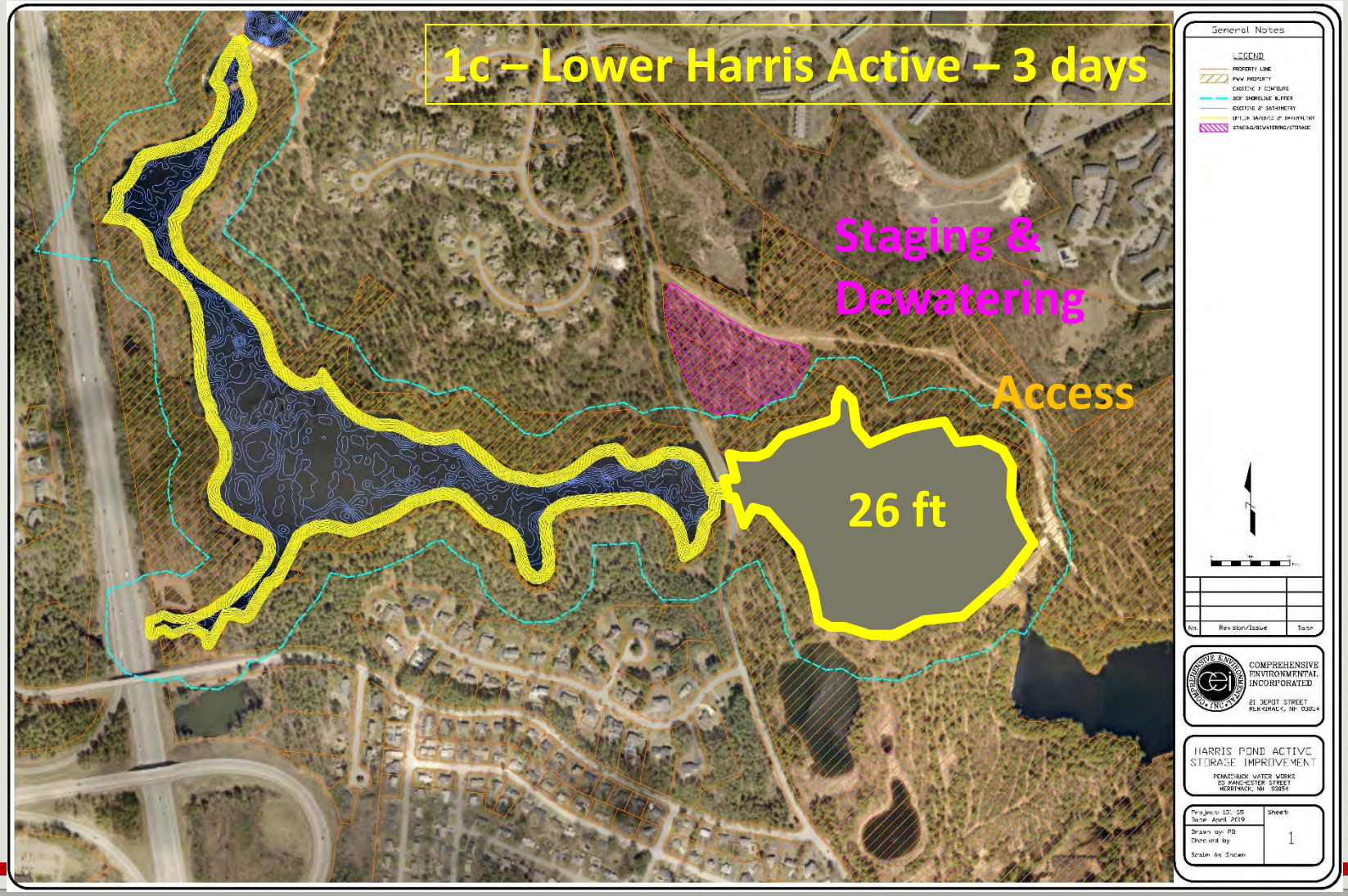
Dredge Options



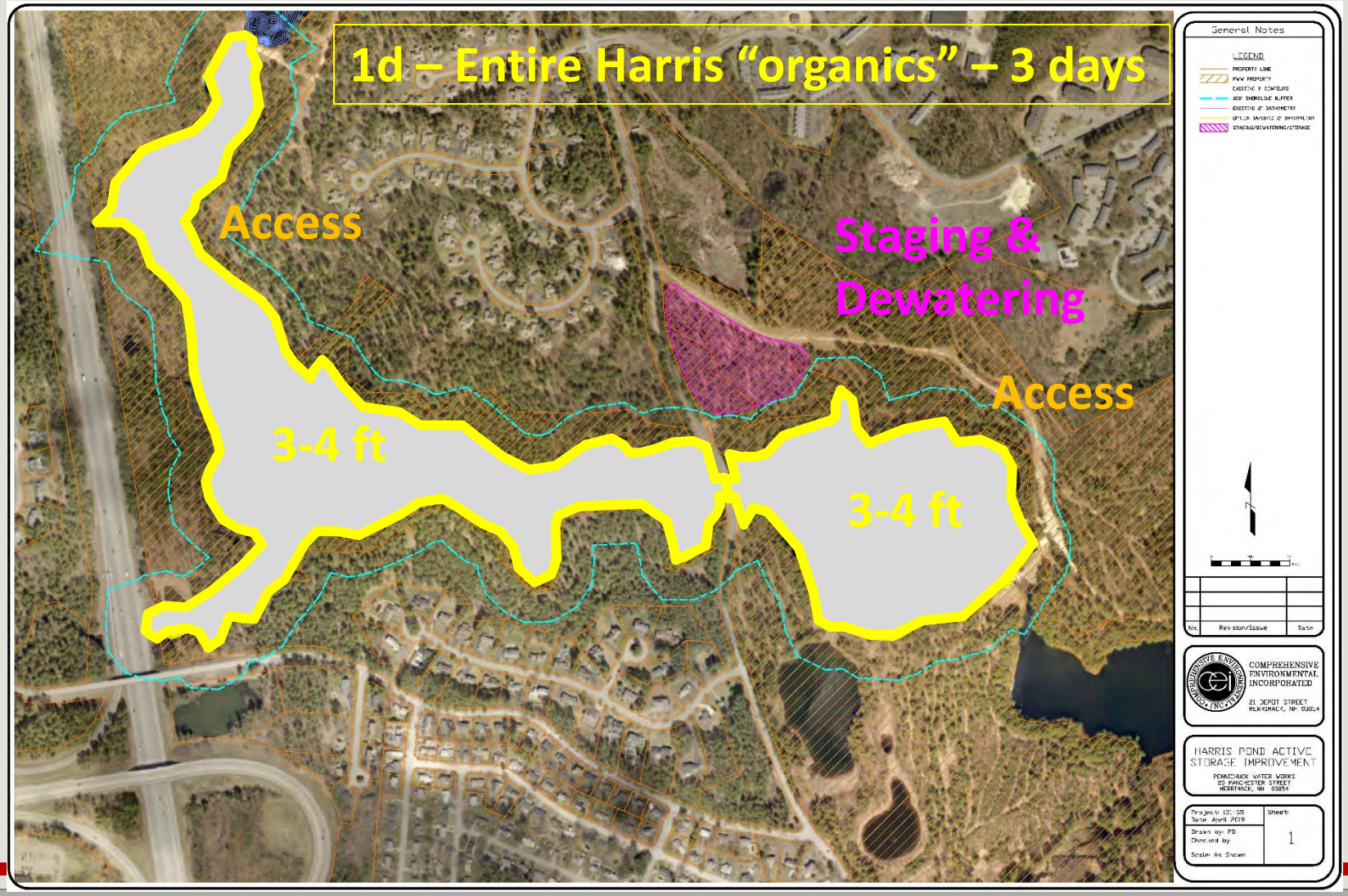
Dredge Options



Dredge Options



Dredge Options



Dredge Considerations

- Dredge Methods:
  - Mechanical Dry
  - Mechanical Wet
  - Hydraulic/pneumatic (recommended)
- Sediment Characteristics:
  - Physical (Methods/dewatering)
  - Chemical (Disposal/Re-use)
- Drawdown & Timelines:
  - Full drawdown – 1 – 2 weeks
  - Assumed 48,000 CY per year (~120 days)

Dredge Considerations

- Staging:
  - Access
  - Equipment
  - PWW property & multiple access points
- Dewatering:
  - Location / Space needed
  - Time Line
  - PWW property & existing access road

Dredge Considerations

- Re-use Options (NHDES permitting):
  - Sampling Plan
  - Contaminant Delineation
  - Final Destination
  - Nearby quarry?
  - Nashua landfill expansion?
  - On Pennichuck Property?
- Impacts:
  - No drawdown required
  - Minimal resource area impacts
  - Supply kept on-line during operations

Dredge Considerations

- Option 1a:
  - Add 80 millions gallons
  - Re-use 400,000 cy
  - Time line – 10-12 years
- Option 1b:
  - Add 50 millions gallons
  - Re-use 250,000 cy
  - Time line – 7-9 years
- Option 1c:
  - Add 30 millions gallons
  - Re-use 150,000 cy
  - Time line – 4-6 years
- Option 1d:
  - Add 25 millions gallons
  - Re-use 130,000 cy
  - Time line – 4-6 years

Dredge Total Costs

Engineering, Permitting, Dredging & Re-use / Disposal

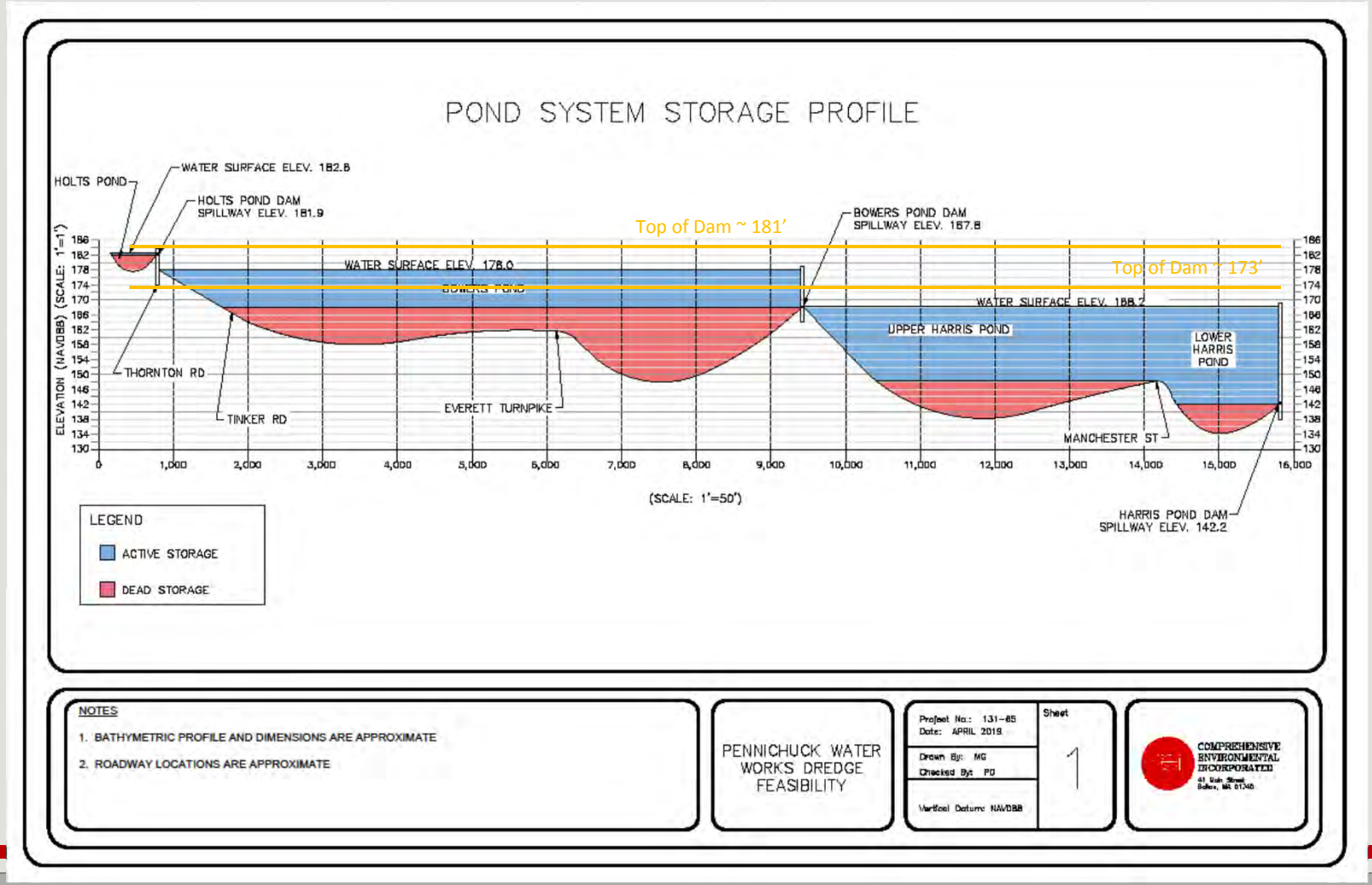
- Option 1a – $7.7 million
- Option 1b – $5.0 million
- Option 1c - $3.0 million
- Option 1d - $2.6 million

Water Level / Outlet Adjustment Options

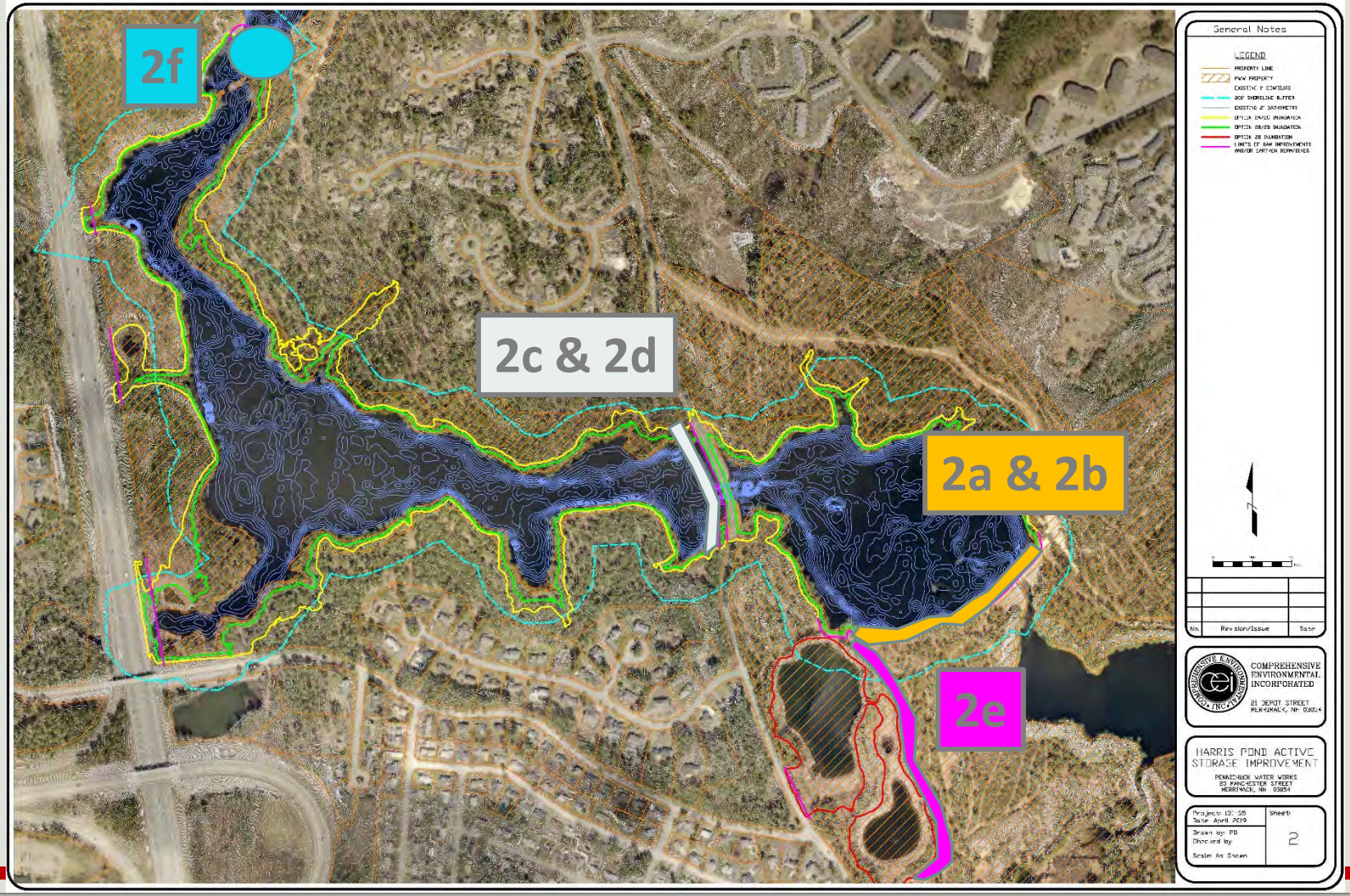
- Option 2a – Raise Harris Dam by 7 feet – 20 days
- Option 2b – Raise Harris Dam by 3 feet – 8 days
- Option 2c – Raise Upper Harris Pond by 7 feet – 14 days
- Option 2d – Raise Upper Harris Pond by 3 feet – 5 days
- Option 2e – Impound adjacent Ponds – 3 days
- Option 2f – Lower Bower's Low Outlet – 3 days

Water Level / Outlet Adjustment Options

Existing Conditions - Pond System Storage & Dam Profiles



Water Level / Outlet Adjustment Options



Water Level / Outlet Adjustment Considerations

- Flood Inundation:
  - Property impacts
  - Infrastructure impacts – bridges, culverts, BMPs
- Dam Features:
  - Structural stability
  - Downstream risks
- Timeline:
  - Partial drawdown
  - Cofferdams
  - 1-2 years for construction

Water Level / Outlet Adjustment Considerations

Dam Structure / Spillway – Sheet Piles

Dam Embankment – Fill adjacent to roadway

Dam Safety – EAP & downstream risks – bridge / roadway

- Earthen Dikes – 2-3 locations along turnpike property
- Timeline – 3 to 4 years
- Impacts:
  - Flood inundation
  - Minimal wetland impacts
  - Bowers outlet & dam structure
  - Lower Harris – No Dam Impacts

Water Level / Outlet Adjustment Considerations

- Option 2a:
  - Add 200 millions gallons
  - Dam modifications
  - Fill material 30,000 CY
  - Time line – 3-4 years
- Option 2c:
  - Add 140 millions gallons
  - Sheet pile 15,000 SF
  - Fill material 23,000 CY
  - Time line – 3-4 years
- Option 2b:
  - Add 80 millions gallons
  - Dam modifications
  - Fill material 13,000 CY
  - Time line – 3-4 years
- Option 2d:
  - Add 55 millions gallons
  - Sheet pile 15,000 SF
  - Fill material 11,000 CY
  - Time line – 3-4 years

Water Level / Outlet Adjustment Considerations

- Option 2e:
  - Add 30 millions gallons
  - Fill material 30,000 CY
  - Time line – 3-4 years
- Option 2f:
  - Add 30 millions gallons
  - Dam modifications
  - Time line – 3-4 years

Water Level / Outlet Adjustment
Total Costs

Engineering, Permitting, Earth Fill & Structural Construction

- Option 2a - $ 3.9 million
- Option 2b - $ 2.4 million
- Option 2c - $ 2.3 million
- Option 2d - $ 1.7 million
- Option 2e - $ 1.8 million
- Option 2f - $ 1.1 million

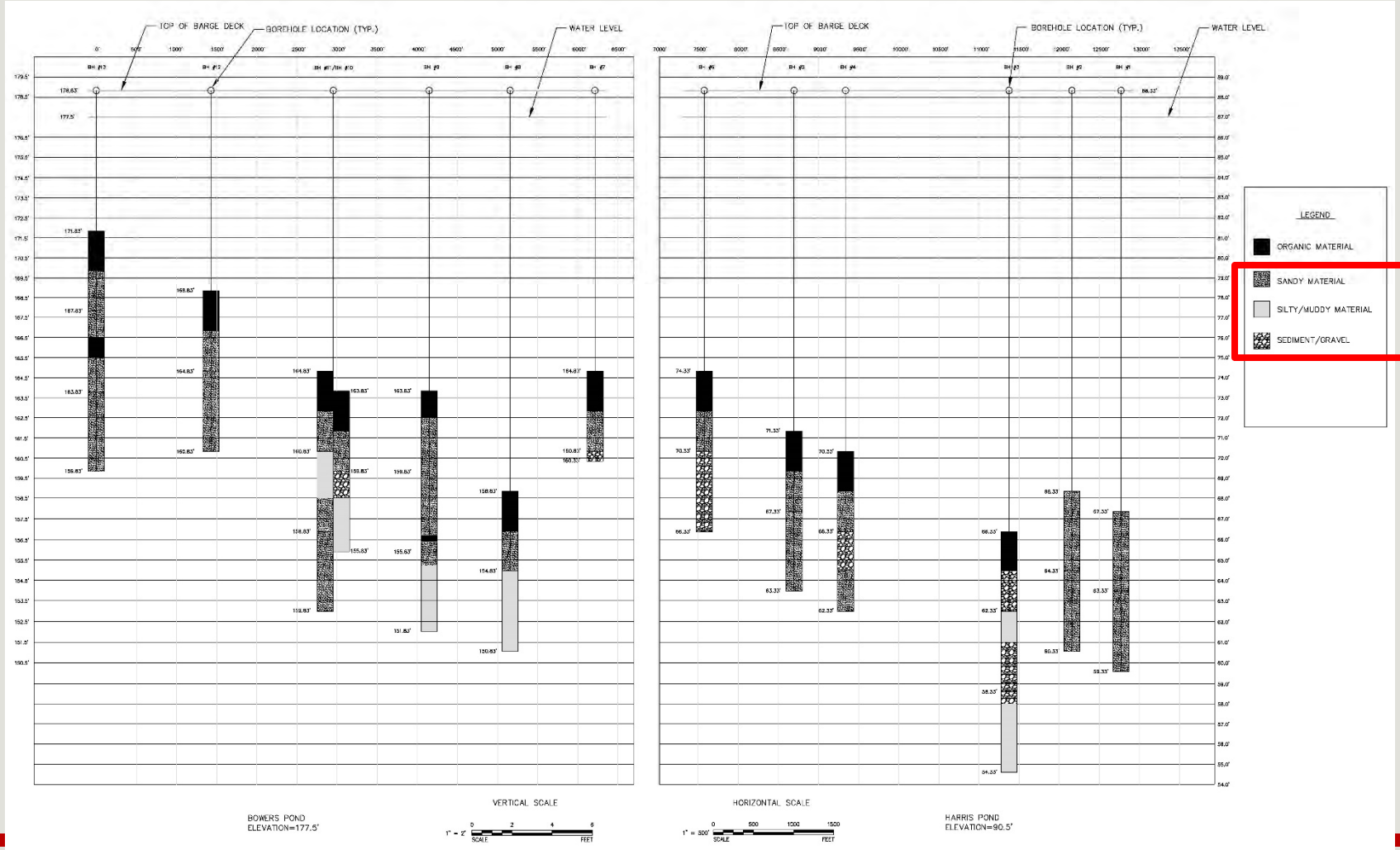
Raw Water Supply Well Options

- Option 3a – Two Lower Harris Wells - 1.0 – 3.0 MGD
- Option 3b – Two Upper Harris Wells - 1.0 – 3.0 MGD
- Option 3c – Two Bowers Wells - 1.0 – 3.0 MGD

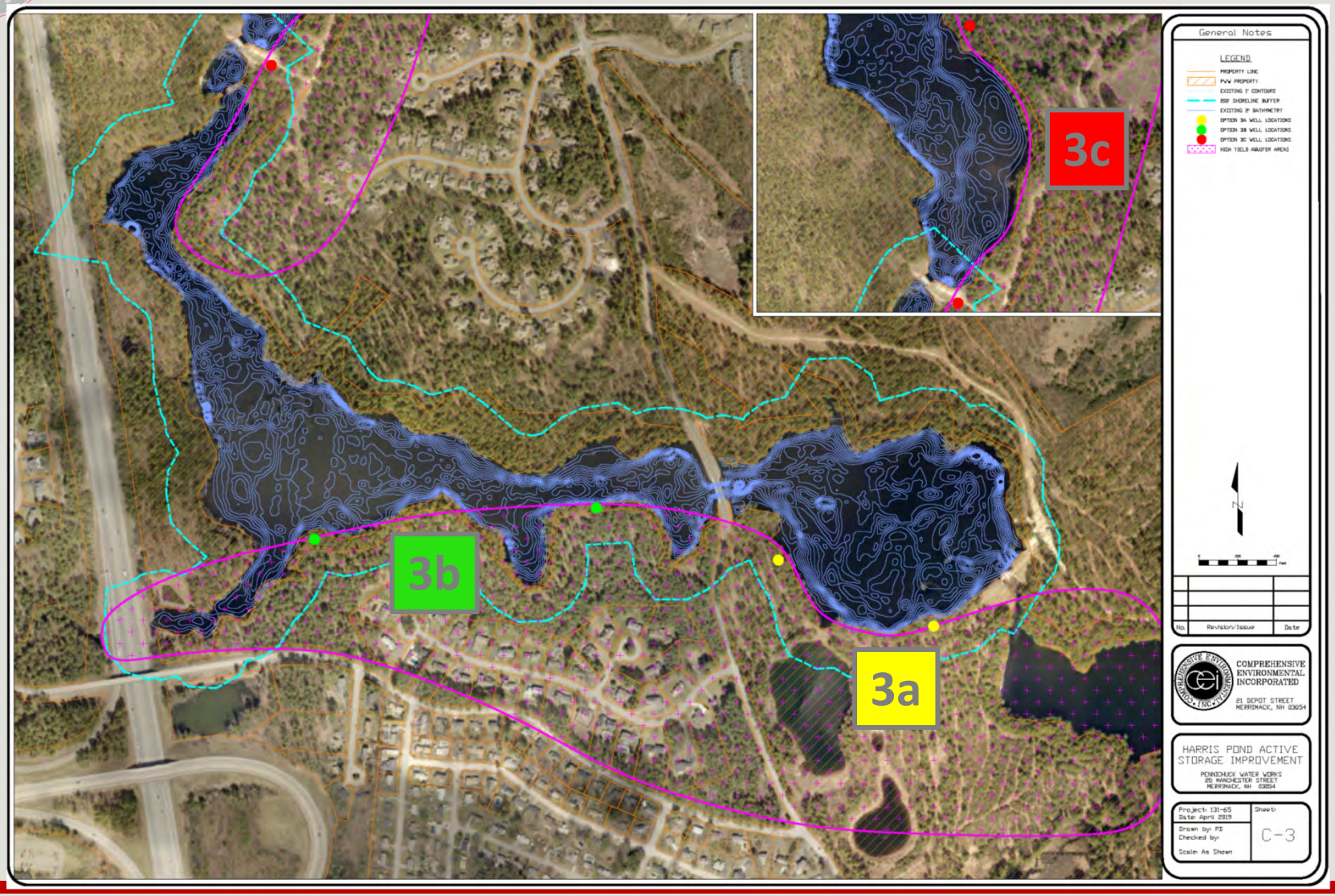
Combined well production could nearly meet daily supply needs

Summary of Current Storage & Supply

Existing Conditions - Sediment Profiles



Raw Water Supply Well Options



Raw Water Supply Well Considerations

- Siting & Pump studies
- Access:
  - Buffers and Shoreland Areas
  - Minimal abutter impacts
- Installation:
  - Access (Harris Wells)
  - Generator hookups & small pumps
  - Minimal piping needed
- Supplemental supply to Merrimack
- Timeline:
  - Testing/Withdrawal Permitting 1-2 years
  - 1-2 years for construction

Raw Water Supply Well Considerations

Bowers/Harris Pond Wells

- Location – High Yield Gravel Aquifer Locations
- 6 wells needed to meet approx. 10 MGD
- Approx. 20 foot well screen
- Timeline – 3-4 years
- Impacts
  - Minimal well depths 60-80 feet
  - Shoreland Impacts
  - Could impact recharge into ponds
  - Additional O&M infrastructure (piping / pumps)

Raw Water Supply Well Considerations

- Option 3a:
  - Add 60 millions gallons
  - Well depth 80 feet
  - Piping 1,200 feet
  - Time line – 3-4 years
- Option 3c:
  - Add 60 millions gallons
  - Well depth 60 feet
  - Piping 1,800 feet
  - Time line – 3-4 years
- Option 3b:
  - Add 60 millions gallons
  - Well depth 80 feet
  - Piping 3,200 feet
  - Time line – 3-4 years

Raw Water Supply Well Costs

Engineering, Permitting, Well Siting Study & Well Install

- Option 3a - $1.2 million - Lower Harris
- Option 3b - $1.3 million - Upper Harris
- Option 3c - $1.2 million - Bowers

Total Costs ~ $3.7 million

Summary of Options

Option	Storage Gained (million gallons)	Cost ($)	Cost / Storage Gained ($/million gallons)
1a - Max. Dredge	80.1	7,700,000	95,800
1b - Upper Dredge	50.9	5,000,000	97,500
1c - Lower Dredge	29.2	2,900,000	99,450
1d - Organic Dredge	26.2	2,600,000	100,100
2a - Raise Lower Harris Dam 7 ft	202.6	3,900,000	19,250
2b - Raise Lower Harris Dam 3 ft	79.7	2,400,000	29,500
2c - Raise Upper Harris 7 feet	137	2,300,000	16,450
2d - Raise Upper Harris 3 feet	53	1,700,000	31,150
2e - Impound Ponds	32.3	1,800,000	56,550
2f- Bower Lower Outlet	29.3	1,100,000	36,700
3a - Lower Harris Wells	60	1,200,000	19,600
3b - Upper Harris Wells	60	1,300,000	21,600
3c -Bowers Wells	60	1,200,000	20,200

Note: Assumed wells could potentially run for 20 days at 3.0 MGD per site.

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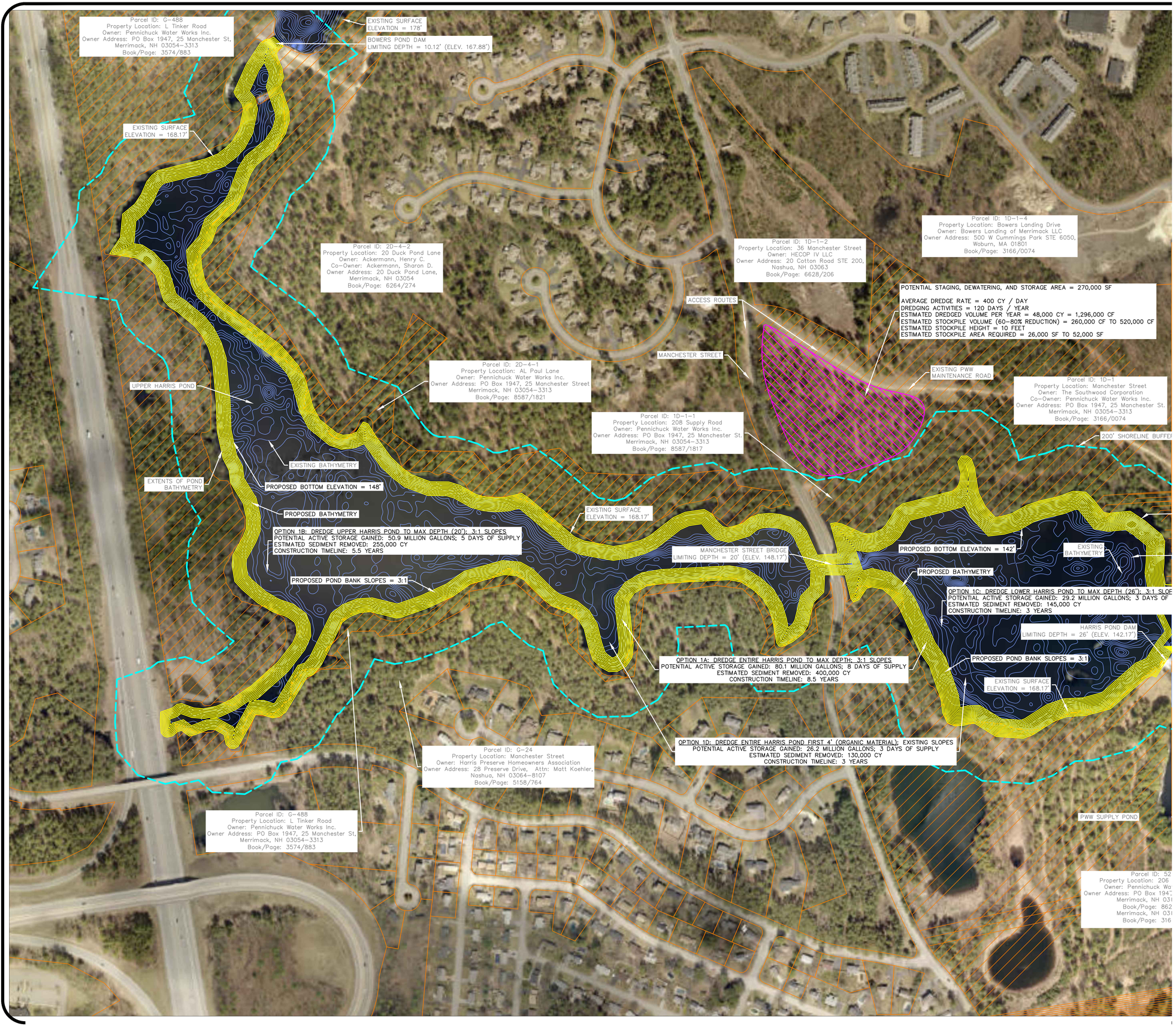
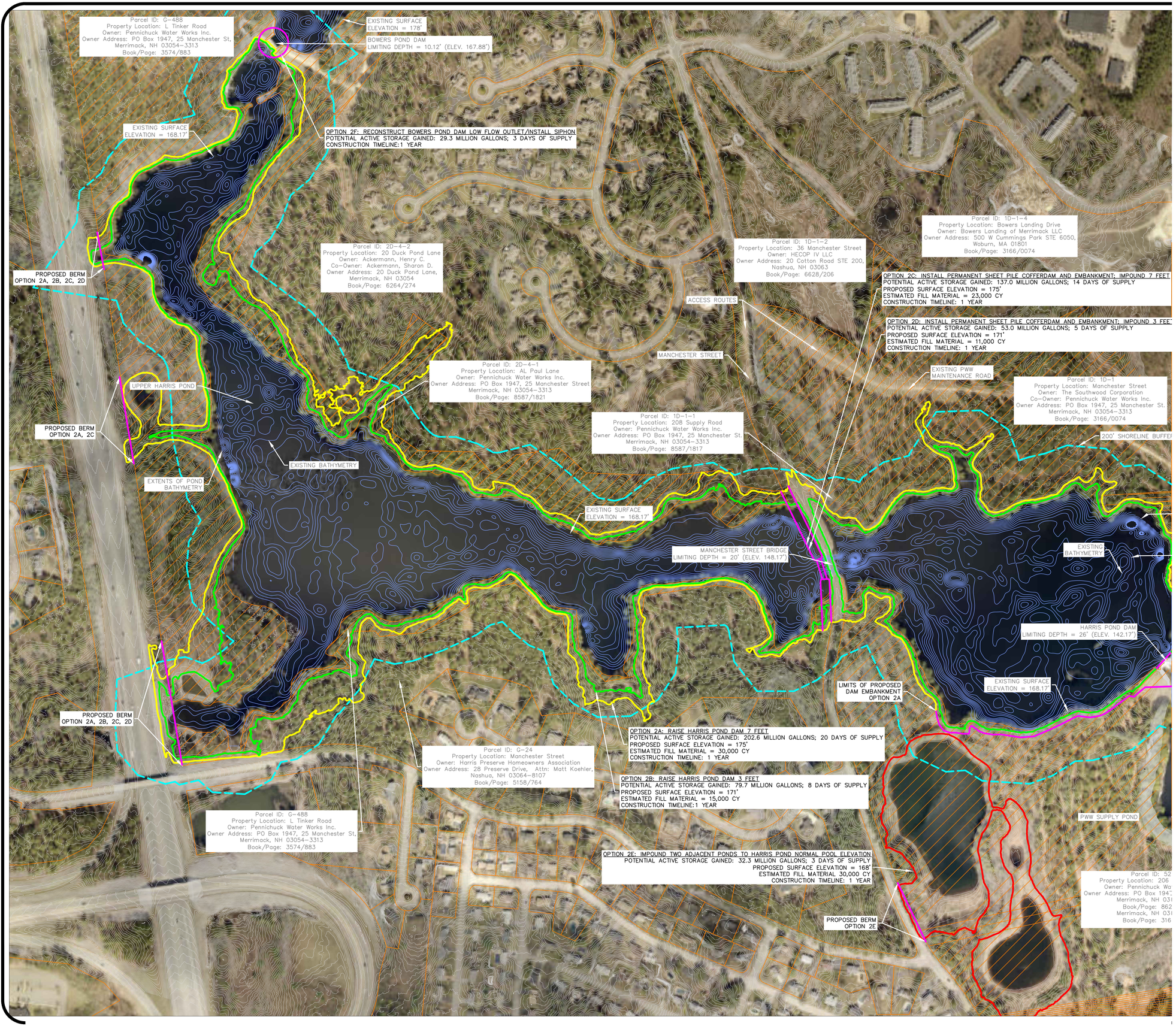

Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883
EXISTING SURFACE ELEVATION = 178'
BOWERS POND DAM
LIMITING DEPTH = 10.12' (ELEV. 167.88')
EXISTING SURFACE ELEVATION = 168.17'
Parcel ID: 2D-4-2
Property Location: 20 Duck Pond Lane
Owner: Ackermann, Henry C.
Co-Owner: Ackermann, Sharon D.
Owner Address: 20 Duck Pond Lane,
Merrimack, NH 03054
Book/Page: 6264/274
Parcel ID: 1D-1-2
Property Location: 36 Manchester Street
Owner: HECOP IV LLC
Owner Address: 20 Cotton Road STE 200,
Nashua, NH 03063
Book/Page: 6628/206
Parcel ID: 1D-1-4
Property Location: Bowers Landing Drive
Owner: Bowers Landing of Merrimack LLC
Owner Address: 500 W Cummings Park STE 6050,
Woburn, MA 01801
Book/Page: 3166/0074
POTENTIAL STAGING, DEWATERING, AND STORAGE AREA = 270,000 SF
AVERAGE DREDGE RATE = 400 CY / DAY
DREDGING ACTIVITIES = 120 DAYS / YEAR
ESTIMATED DREDGED VOLUME PER YEAR = 48,000 CY = 1,296,000 CF
ESTIMATED STOCKPILE VOLUME (60-80% REDUCTION) = 260,000 CF TO 520,000 CF
ESTIMATED STOCKPILE HEIGHT = 10 FEET
ESTIMATED STOCKPILE AREA REQUIRED = 26,000 SF TO 52,000 SF
ACCESS ROUTES
MANCHESTER STREET
EXISTING PWW MAINTENANCE ROAD
Parcel ID: 2D-4-1
Property Location: AL Paul Lane
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester Street
Merrimack, NH 03054-3313
Book/Page: 8587/1821
Parcel ID: 1D-1
Property Location: Manchester Street
Owner: The Southwood Corporation
Co-Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 3166/0074
UPPER HARRIS POND
Parcel ID: 1D-1-1
Property Location: 208 Supply Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 8587/1817
200' SHORELINE BUFFE
EXISTING BATHYMETRY
EXTENTS OF POND BATHYMETRY
PROPOSED BOTTOM ELEVATION = 148'
PROPOSED BATHYMETRY
EXISTING SURFACE ELEVATION = 168.17'
OPTION 1B: DREDGE UPPER HARRIS POND TO MAX DEPTH (20'); 3:1 SLOPES
POTENTIAL ACTIVE STORAGE GAINED: 50.9 MILLION GALLONS; 5 DAYS OF SUPPLY
ESTIMATED SEDIMENT REMOVED: 255,000 CY
CONSTRUCTION TIMELINE: 5.5 YEARS
MANCHESTER STREET BRIDGE
LIMITING DEPTH = 20' (ELEV. 148.17')
PROPOSED BOTTOM ELEVATION = 142'
EXISTING BATHYMETRY
PROPOSED BATHYMETRY
PROPOSED POND BANK SLOPES = 3:1
OPTION 1C: DREDGE LOWER HARRIS POND TO MAX DEPTH (26'); 3:1 SLOP
POTENTIAL ACTIVE STORAGE GAINED: 29.2 MILLION GALLONS; 3 DAYS OF
ESTIMATED SEDIMENT REMOVED: 145,000 CY
CONSTRUCTION TIMELINE: 3 YEARS
HARRIS POND DAM
LIMITING DEPTH = 26' (ELEV. 142.17')
OPTION 1A: DREDGE ENTIRE HARRIS POND TO MAX DEPTH; 3:1 SLOPES
POTENTIAL ACTIVE STORAGE GAINED: 80.1 MILLION GALLONS; 8 DAYS OF SUPPLY
ESTIMATED SEDIMENT REMOVED: 400,000 CY
CONSTRUCTION TIMELINE: 8.5 YEARS
PROPOSED POND BANK SLOPES = 3:1
EXISTING SURFACE ELEVATION = 168.17'
OPTION 1D: DREDGE ENTIRE HARRIS POND FIRST 4' (ORGANIC MATERIAL); EXISTING SLOPES
POTENTIAL ACTIVE STORAGE GAINED: 26.2 MILLION GALLONS; 3 DAYS OF SUPPLY
ESTIMATED SEDIMENT REMOVED: 130,000 CY
CONSTRUCTION TIMELINE: 3 YEARS
Parcel ID: G-24
Property Location: Manchester Street
Owner: Harris Preserve Homeowners Association
Owner Address: 28 Preserve Drive, Attn: Matt Koehler,
Nashua, NH 03064-8107
Book/Page: 5158/764
Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883
PWW SUPPLY POND
Parcel ID: 52
Property Location: 206
Owner: Pennichuck Wa
Owner Address: PO Box 194
Merrimack, NH 031
Book/Page: 862
Merrimack, NH 031
Book/Page: 316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Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883
EXISTING SURFACE ELEVATION = 178'
BOWERS POND DAM
LIMITING DEPTH = 10.12' (ELEV. 167.88')
EXISTING SURFACE ELEVATION = 168.17'
OPTION 2F: RECONSTRUCT BOWERS POND DAM LOW FLOW OUTLET/INSTALL SIPHON
POTENTIAL ACTIVE STORAGE GAINED: 29.3 MILLION GALLONS; 3 DAYS OF SUPPLY
CONSTRUCTION TIMELINE: 1 YEAR
PROPOSED BERM
OPTION 2A, 2B, 2C, 2D
Parcel ID: 2D-4-2
Property Location: 20 Duck Pond Lane
Owner: Ackermann, Henry C.
Co-Owner: Ackermann, Sharon D.
Owner Address: 20 Duck Pond Lane,
Merrimack, NH 03054
Book/Page: 6264/274
Parcel ID: 1D-1-2
Property Location: 36 Manchester Street
Owner: HECOP IV LLC
Owner Address: 20 Cotton Road STE 200,
Nashua, NH 03063
Book/Page: 6628/206
Parcel ID: 1D-1-4
Property Location: Bowers Landing Drive
Owner: Bowers Landing of Merrimack LLC
Owner Address: 500 W Cummings Park STE 6050,
Woburn, MA 01801
Book/Page: 3166/0074
OPTION 2C: INSTALL PERMANENT SHEET PILE COFFERDAM AND EMBANKMENT; IMPOUND 7 FEET
POTENTIAL ACTIVE STORAGE GAINED: 137.0 MILLION GALLONS; 14 DAYS OF SUPPLY
PROPOSED SURFACE ELEVATION = 175'
ESTIMATED FILL MATERIAL = 23,000 CY
CONSTRUCTION TIMELINE: 1 YEAR
ACCESS ROUTES
OPTION 2D: INSTALL PERMANENT SHEET PILE COFFERDAM AND EMBANKMENT; IMPOUND 3 FEET
POTENTIAL ACTIVE STORAGE GAINED: 53.0 MILLION GALLONS; 5 DAYS OF SUPPLY
PROPOSED SURFACE ELEVATION = 171'
ESTIMATED FILL MATERIAL = 11,000 CY
CONSTRUCTION TIMELINE: 1 YEAR
MANCHESTER STREET
Parcel ID: 2D-4-1
Property Location: AL Paul Lane
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester Street
Merrimack, NH 03054-3313
Book/Page: 8587/1821
EXISTING PWW MAINTENANCE ROAD
Parcel ID: 1D-1
Property Location: Manchester Street
Owner: The Southwood Corporation
Co-Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 3166/0074
UPPER HARRIS POND
PROPOSED BERM
OPTION 2A, 2C
Parcel ID: 1D-1-1
Property Location: 208 Supply Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 8587/1817
200' SHORELINE BUFFER
EXISTING BATHYMETRY
EXTENTS OF POND BATHYMETRY
EXISTING SURFACE ELEVATION = 168.17'
MANCHESTER STREET BRIDGE
LIMITING DEPTH = 20' (ELEV. 148.17')
EXISTING BATHYMETRY
HARRIS POND DAM
LIMITING DEPTH = 26' (ELEV. 142.17')
EXISTING SURFACE ELEVATION = 168.17'
LIMITS OF PROPOSED DAM EMBANKMENT OPTION 2A
PROPOSED BERM
OPTION 2A, 2B, 2C, 2D
OPTION 2A: RAISE HARRIS POND DAM 7 FEET
POTENTIAL ACTIVE STORAGE GAINED: 202.6 MILLION GALLONS; 20 DAYS OF SUPPLY
PROPOSED SURFACE ELEVATION = 175'
ESTIMATED FILL MATERIAL = 30,000 CY
CONSTRUCTION TIMELINE: 1 YEAR
Parcel ID: G-24
Property Location: Manchester Street
Owner: Harris Preserve Homeowners Association
Owner Address: 28 Preserve Drive, Attn: Matt Koehler,
Nashua, NH 03064-8107
Book/Page: 5158/764
OPTION 2B: RAISE HARRIS POND DAM 3 FEET
POTENTIAL ACTIVE STORAGE GAINED: 79.7 MILLION GALLONS; 8 DAYS OF SUPPLY
PROPOSED SURFACE ELEVATION = 171'
ESTIMATED FILL MATERIAL = 15,000 CY
CONSTRUCTION TIMELINE: 1 YEAR
Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883
PWW SUPPLY POND
OPTION 2E: IMPOUND TWO ADJACENT PONDS TO HARRIS POND NORMAL POOL ELEVATION
POTENTIAL ACTIVE STORAGE GAINED: 32.3 MILLION GALLONS; 3 DAYS OF SUPPLY
PROPOSED SURFACE ELEVATION = 168'
ESTIMATED FILL MATERIAL 30,000 CY
CONSTRUCTION TIMELINE: 1 YEAR
Parcel ID: 52
Property Location: 206
Owner: Pennichuck Wa
Owner Address: PO Box 194
Merrimack, NH 031
Book/Page: 862
Merrimack, NH 031
Book/Page: 316
PROPOSED BERM
OPTION 2E

Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883

EXISTING SURFACE
ELEVATION = 178'

BOWERS POND DAM
LIMITING DEPTH = 10.12' (ELEV. 167.88')

OPTION 3C: INSTALL TWO WELLS EAST OF BOWERS POND
POTENTIAL SUPPLY GAINED: 3 MILLION GALLONS PER DAY
LENGTH OF PIPE REQUIRED = 1,800 LF
CONSTRUCTION TIMELINE: 1 YEAR

EXISTING SURFACE
ELEVATION = 168.17'

Parcel ID: 2D-4-2
Property Location: 20 Duck Pond Lane
Owner: Ackermann, Henry C.
Co-Owner: Ackermann, Sharon D.
Owner Address: 20 Duck Pond Lane,
Merrimack, NH 03054
Book/Page: 6264/274

Parcel ID: 1D-1-2
Property Location: 36 Manchester Street
Owner: HECOP IV LLC
Owner Address: 20 Cotton Road STE 200,
Nashua, NH 03063
Book/Page: 6628/206

ACCESS ROUTES

MANCHESTER STREET

Parcel ID: 2D-4-1
Property Location: AL Paul Lane
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester Street
Merrimack, NH 03054-3313
Book/Page: 8587/1821

Parcel ID: 1D-1-1
Property Location: 208 Supply Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 8587/1817

EXISTING PWW
MAINTENANCE ROAD

Parcel ID: 1D-1
Property Location: Manchester Street
Owner: The Southwood Corporation
Co-Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St.
Merrimack, NH 03054-3313
Book/Page: 3166/0074

200' SHORELINE BUFFE

UPPER HARRIS POND

EXISTING BATHYMETRY

EXTENTS OF POND
BATHYMETRY

EXISTING SURFACE
ELEVATION = 168.17'

MANCHESTER STREET BRIDGE
LIMITING DEPTH = 20' (ELEV. 148.17')

EXISTING
BATHYMETRY

HARRIS POND DAM
LIMITING DEPTH = 26' (ELEV. 142.17')

EXISTING SURFACE
ELEVATION = 168.17'

OPTION 3B: INSTALL TWO WELLS SOUTH OF UPPER HARRIS POND
POTENTIAL SUPPLY GAINED: 3 MILLION GALLONS PER DAY
LENGTH OF PIPE REQUIRED = 3,200 LF
CONSTRUCTION TIMELINE: 1 YEAR

Parcel ID: G-24
Property Location: Manchester Street
Owner: Harris Preserve Homeowners Association
Owner Address: 28 Preserve Drive, Attn: Matt Koehler,
Nashua, NH 03064-8107
Book/Page: 5158/764

OPTION 3A: INSTALL TWO WELLS SOUTH OF LOWER HARRIS POND
POTENTIAL SUPPLY GAINED: 3 MILLION GALLONS PER DAY
LENGTH OF PIPE REQUIRED = 1,200 LF
CONSTRUCTION TIMELINE: 1 YEAR

Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883

PWW SUPPLY POND

Parcel ID: 52
Property Location: 206
Owner: Pennichuck Wa
Owner Address: PO Box 194
Merrimack, NH 03
Book/Page: 862
Merrimack, NH 03
Book/Page: 316

OPTION 3C: INSTALL TWO WELLS EAST OF BOWERS POND
POTENTIAL SUPPLY GAINED: 3 MILLION GALLONS PER DAY
LENGTH OF PIPE REQUIRED = 1,800 LF
CONSTRUCTION TIMELINE: 1 YEAR

Parcel ID: G-488
Property Location: L Tinker Road
Owner: Pennichuck Water Works Inc.
Owner Address: PO Box 1947, 25 Manchester St,
Merrimack, NH 03054-3313
Book/Page: 3574/883

Active Storage Improvement Options	Description	Gained Storage (million gallons)	Gained Supply (days)	Total Costs	Cost per Storage Gained ($/million gallons)	Potential Permitting Requirements	Engineering / Construction Considerations	Time to Completion
(1) Dredging	(1a) Dredge Upper and Lower Harris Pond to the maximum depths; maintain 3:1 side slopes	80.1	8	Permitting: $100,000 Engineering/Oversight: $150,000 Sampling: $20,000 Construction[1]: $7,400,000 Total: $7,670,000	$95,800	1. U.S. Army Corp of Engineers - State Programmatic General Permit (SPGP) or Individual Permit (IP) 2. NHDES Alteration of Terrain Permit Application (RSA 485-A:17, Env-Wq 1500) 3. NHDES Shoreland Permit Application (RSA 483-9, Env-Wq 1400) 4. NHDES Wetland Permit Application (Major) (RSA 482-A, Env-Wq 100-900) - Waste Management Division Review - 401 Water Quality Certification Program - NH Natural Heritage Bureau (NHB) Review - NH Division of Historical Resources (DHR) Review - NH Fish & Game Department (FGD) Review	1. Dredge Material - 400,000 / 255,000 / 145,000 / 130,000 CY - estimated dredged material[2] - 120,000 / 76,500 / 43,500 / 39,000 CY - estimated dewatered material[3] - 20 / 16 / 13 / 12 samples - estimated based on example sampling protocol[4] 2. Dredging / Dewatering Methods - mechanical dry dredging - mechanical wet dredging - hydraulic/pneumatic dredging (recommended) - quantity and physical characteristics of dredge material - full or partial pond drawdown not feasible for multi-year dredge project 3. Access Routes / Staging / Dewatering / Storage Areas - outside of the 200' shoreline buffer - PWW property - existing maintenance road / Manchester Street - multiple access points 4. Disposal / Reuse Options - quantity and chemical characteristics of dredge material - develop sampling plan - contaminant delineation and treatment - reuse locations / certified treatment or disposal facilities	Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 8.5 years Total: 10 - 11.5 years
	(1b) Dredge Upper Harris Pond to the maximum depth of 20'; maintain 3:1 side slopes	50.9	5	Permitting: $100,000 Engineering/Oversight: $125,000 Sampling: $16,000 Construction[1]: $4,720,000 Total: $4,961,000	$97,500			Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 5.5 years Total: 7 - 8.5 years
	(1c) Dredge Lower Harris Pond to the maximum depth of 26'; maintain 3:1 side slopes	29.2	3	Permitting: $100,000 Engineering/Oversight: $100,000 Sampling: $13,000 Construction[1]: $2,690,000 Total: $2,903,000	$99,450			Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 3 years Total: 4.5 - 6 years
	(1d) Dredge Upper and Lower Harris Pond; first 4 feet of material (organic material); maintain existing side slopes	26.2	3	Permitting: $100,000 Engineering/Oversight: $100,000 Sampling: $12,000 Construction[1]: $2,410,000 Total: $2,622,000	$100,100			Permitting: 1 - 2 years Design: 0.5 - 1 year Construction[5]: 3 years Total: 4.5 - 6 years
(2) Water Level / Outlet Adjustment	(2a) Raise Harris Pond Dam 7 feet; impound 7 feet of Upper and Lower Harris Pond	202.6	20	Permitting: $100,000 Engineering/Oversight: $300,000 Construction: $3,500,000 Total: $3,900,000	$19,250	1. U.S. Army Corp of Engineers - State Programmatic General Permit (SPGP) or Individual Permit (IP) 2. NHDES Alteration of Terrain Permit Application (RSA 485-A:17, Env-Wq 1500) 3. NHDES Shoreland Permit Application (RSA 483-9, Env-Wq 1400) 4. NHDES Wetland Permit Application (Major) (RSA 482-A, Env-Wq 100-900) - NH Natural Heritage Bureau (NHB) Review - NH Division of Historical Resources (DHR) Review - NH Fish & Game Department (FGD) Review 5. NHDES Water Division/Dam Bureau Application for Permit to Construct or Reconstruct a Dam (Env-Wr 400, RSA 482:9 and 482:29)	1. Hydraulic & Hydrologic Study - model various storm scenarios - changes in downstream flooding in the event of a dam failure - flooding adjacent properties / infrastructure (bridges, culverts, BMPs) - lag time to impound/access the surplus storage volume/supply 2. Geotechnical Study 3. Survey 4. Partial Drawdown 5. Embankment / Spillway / Gatehouse / Low Flow Outlet / Pedestrian Bridge Redesign - maintain 2' freeboard 6. Cofferdam / Embankment Design - two 50' high x 150' long steel sheet piles; 15' embedment 7. Fill Material (dam embankment and/or earthen berm/dikes) - 30,000 / 13,000 / 23,000 / 11,000 CY - estimated fill required[7] 8. Access Routes / Staging / Materials Storage Areas	Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(2b) Raise Harris Pond Dam 3 feet; impound 3 feet of Upper and Lower Harris Pond	79.7	8	Permitting: $100,000 Engineering/Oversight: $250,000 Construction: $2,000,000 Total: $2,350,000	$29,500			Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(2c) Install permanent sheet pile cofferdam and embankment on the Upper Harris side of Manchester Street Bridge; impound 7 feet of Upper Harris Pond	137.0	14	Permitting: $100,000 Engineering/Oversight: $250,000 Construction[6]: $1,900,000 Total: $2,250,000	$16,450			Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(2d) Install permanent sheet pile cofferdam and embankment on the Upper Harris side of Manchester Street Bridge; impound 3 feet of Upper Harris Pond	53.0	5	Permitting: $100,000 Engineering/Oversight: $250,000 Construction[6]: $1,300,000 Total: $1,650,000	$31,150			Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(2e) Construct a berm around the two adjacent ponds; impound adjacent ponds to Harris Pond normal pool elevation and create hydraulic connection to Harris Pond	32.3	3	Permitting: $75,000 Engineering/Oversight: $250,000 Construction[8]: $1,500,000 Total: $1,825,000	$56,550	1. U.S. Army Corp of Engineers - State Programmatic General Permit (SPGP) or Individual Permit (IP) 2. NHDES Alteration of Terrain Permit Application (RSA 485-A:17, Env-Wq 1500) 3. NHDES Shoreland Permit Application (RSA 483-9, Env-Wq 1400) 4. NHDES Wetland Permit Application (Minor) (RSA 482-A, Env-Wq 100-900) - NH Natural Heritage Bureau (NHB) Review - NH Division of Historical Resources (DHR) Review - NH Fish & Game Department (FGD) Review 5. NHDES Water Division/Dam Bureau Application for Permit to Construct or Reconstruct a Dam (Env-Wr 400, RSA 482:9 and 482:29)	1. Hydraulic & Hydrologic Study - model various storm scenarios - changes in downstream flooding in the event of a berm failure - flooding adjacent properties / roads - lag time to impound/access the surplus storage volume/supply 2. Survey 3. Berm Design - maintain 2' freeboard 4. Fill Material (earthen berm/dikes) - 30,000 CY - estimated fill required 5. Access Routes / Staging / Materials Storage Areas	Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(2f) Reconstruct Bowers Pond Dam low flow outlet or install siphon to access 50% of the dead storage in Bowers Pond	29.3	3	Permitting: $75,000 Engineering/Oversight: $250,000 Construction: $750,000 Total: $1,075,000	$36,700	1. NHDES Shoreland Permit Application (RSA 483-9, Env-Wq 1400) 2. NHDES Wetland Permit Application (Major) (RSA 482-A, Env-Wq 100-900) - NH Natural Heritage Bureau (NHB) Review - NH Division of Historical Resources (DHR) Review - NH Fish & Game Department (FGD) Review 3. NHDES Water Division/Dam Bureau Application for Permit to Construct or Reconstruct a Dam (Env-Wr 400, RSA 482:9 and 482:29)	1. Elevation and Bathymetry Study 2. Survey 3. Low Flow Outlet / Siphon Design 4. Access Routes / Staging / Materials Storage Areas	Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
(3) Raw Water Supply Wells	(3a) Install two wells south of Lower Harris Pond (80 feet deep); pipe to supply pond[10]	60	6	Permitting: $200,000 Design: $200,000 Construction[9]: $775,000 Total: $1,175,000	$19,600	1. NHDES Alteration of Terrain Permit Application (RSA 485-A:17, Env-Wq 1500) 2. NHDES Shoreland Permit Application (RSA 483-9, Env-Wq 1400) 3. NHDES Large Groundwater Withdrawal Permit	1. Siting and Pump Studies - transmissivity data of soils - locations of high yield gravel aquifers - imact to pond recharge 2. Test Wells / Borings / Subsurface Exploration 3. Location / Depth of Wells - proximity of wells to intake may impact cost of construction - well screen depth 4. Submersible Well, Pump, and Pipe Sizing - 1,200 / 3,200 / 1,800 LF - estimated piping[11] 5. Access Routes 6. Requires Mobile Generator 7. Operation and Maintenance	Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(3b) Install two wells south of Upper Harris Pond (80 feet deep); pipe to supply pond[10]	60	6	Permitting: $200,000 Design: $200,000 Construction[9]: $895,000 Total: $1,295,000	$21,600			Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years
	(3c) Install two wells east of Bowers Pond; one near Bowers Pond Dam and one south of Thornton Road (60 feet deep); pipe to Bowers Pond Dam outlet[10]	60	6	Permitting: $200,000 Design: $200,000 Construction[9]: $810,000 Total: $1,210,000	$20,200			Permitting: 1 - 2 years Design: 1 year Construction: 1 year Total: 3 - 4 years

[1]Based on an average hydraulic dredging cost of $18.50 per CY of dredge material removed and dewatered.
[2]Estimated dredge material removed in dredging scenario 1a, 1b, 1c, and 1d, respectively.
[3]Estimated dewatered material in dredging scenario 1a, 1b, 1c, and 1d, respectively. Based on 60-80% volume reduction of dredged material after dewatering.
[4]Estimated additional samples required in dredging scenario 1a, 1b, 1c, and 1d, respectively. Example sampling protocol: one sample per 2,000 CY up to 20,000 CY, and then one sample per 10,000 CY. Results above soil remediation standards may require more sampling and consistent results below soil remediation standards may warrant less sampling. Sampling protocol may be subject to review/suggestions by NHDES Waste Management Division. Estimated $1000 per sample/lab analysis.
[5]Based on average dredge rate of 400 CY per day for duration of 120 days per year. 48,000 CY can be dredged per year.
[6]Based on average steel sheet pile cost of $50 per SF and fill material at $50 per CY.
[7]Estimated fill material required (dam embankments/berms/dikes) for scenario 2a, 2b, 2c, and 2d, respectively.
[8]Based on fill material at $50 per CY.
[9]Based on average 12"-18" diameter gravel packed well cost of $300,000 Ea., $60 per LF of 16" HDPE pipe, and $50,00 per pump and generator hook up.
[10]Assuming the wells can operate at 3 million gallons per day for 20 days.
[11]Estimated piping length required for scenario 3a, 3b, and 3c, respectively.